Snohomish County Drainage Manual

Volume I
Minimum Technical Requirements

September 2010

Table of Contents

Tables

Figures

Chapter 1 - Introduction

1.1 Background and Objective

1.1.1 Background

This manual represents another significant step taken by Snohomish County to address stormwater issues. Historically, the objective of stormwater management was flood control largely intended to prevent damage to human-built infrastructure and property. Little concern was given to the environmental effects of this approach.

Through the last several decades, stormwater was identified as one of the leading causes of water-resource-related environmental problems in developed areas. In 1995, the County began operating under a National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit, and as a result adopted into regulations the equivalent of the 1992 Stormwater Management Manual for the Puget Sound Basin, published by the Washington State Department of Ecology. The 1992 Ecology Manual contained standards for stormwater flow control that were far more stringent than preexisting standards. The 1992 standards were intended to prevent stream destabilization based on studies of sediment transport and stream incision. The 1992 Manual also contained standards for stormwater treatment, which up to that point had typically not been required on projects. The 1992 Manual also contained erosion control standards based on a nationwide review of such standards.

The NPDES municipal stormwater permit was reissued in 2007, and this permit requires Snohomish County to adopt the equivalent of Ecology's 2005 Stormwater Management Manual for Western Washington. The 2005 Ecology Manual, to which the new Snohomish County Manual is equivalent, contains flow control standards more stringent than those in the 1992 Ecology Manual, based on further studies of stream stability and an improved hydrologic modeling method. More stringent treatment standards are included as well.

1.1.2 Stormwater and Low Impact Development

The 2005 Ecology Manual contains measures to implement the concept of "stormwater low impact development," or stormwater LID. The intent of stormwater LID is to mimic predeveloped runoff conditions more effectively than is done by the "conventional" development and stormwater management approach. In the conventional approach to stormwater management, stormwater is routed as efficiently as possible to engineered flow control and treatment systems located at one part of a developed site. Little consideration is given to minimizing the amount of impervious surface or land disturbance. In contrast, a main goal of stormwater LID is to minimize impervious surface and land disturbance, maximize retention of native vegetation and soils, and to build multiple small systems on a site that allow infiltration and dispersion of runoff as close to the source as possible.

This manual and Snohomish County's drainage and land-disturbing activity codes operate at the project scale. At that scale, and from the perspective of drainage engineering and plan review, stormwater LID and conventional stormwater management have a fair amount in common. Stormwater LID relies heavily on infiltration of water into soil, which is well understood and incorporated into both conventional stormwater facilities (such as infiltration ponds) and LID

facilities and materials (such as bioretention systems and permeable pavement). Engineering standards, specifications, design and construction criteria are well documented for these facilities and materials.

There is much discussion of the need for incorporating stormwater LID into watershed-scale actions such as land use planning. The Drainage Manual is not invoked in watershed-scale land use planning, but even at the project scale there are opportunities to incorporate concepts of LID at the project planning and early design decision processes. Doing so could provide a considerable departure from conventional stormwater management. For example, decisions about where to locate a building on a lot and decisions about other land surfaces that will be installed can affect the feasibility of installing on-site stormwater infiltration or dispersion trenches. Such decision processes are within the scope of "site-scale" regulations such as a drainage code, but a given decision process could drive quite different outcomes depending on how the decisions within it are sequenced.

To facilitate the implementation of well-documented stormwater LID BMPs, this manual has designated various BMPs as LID BMPs. These BMPs are found in Volumes III and V of this manual, and are listed in Volume I, Appendix I-A.

In the coming years, we anticipate working with Ecology and other jurisdictions on further improvements to stormwater management. Topics that need further refinement include:

- Further refinement of standards for implementing stormwater LID where it is appropriate and recognizing where it is not;
- Better coordination among state agencies on the topics of stormwater management as regulated primarily under the federal Clean Water Act and groundwater management as regulated by the federal Safe Drinking Water Act; and
- More efficient ways to get innovative stormwater management technologies tested and approved for use by local governments and the private sector.

1.1.3 Objective of this manual

The objective of this manual is to set forth requirements for identifying, selecting, designing, and implementing stormwater management best management practices (BMPs) required by Snohomish County codes, primarily Snohomish County Code (SCC) Title 30 - Unified Development Code, and Chapter 7.53 SCC - Water Pollution Control. This manual also provides additional non-binding guidance and recommendations about these BMPs. The requirements set forth in this manual apply within the unincorporated area of Snohomish County.

If any conflict exists between the requirements or definitions of Chapters 30.63A, 30.63B, or 30.63C SCC and this manual, the requirements and definitions of the code chapters shall control. Similarly, if any conflict exists between the requirements or definitions of Snohomish County Engineering Design and Development Standards (EDDS) and this manual, the requirements and definitions of the EDDS shall control.

The purpose of the stormwater management BMPs contained in this manual is to control the quantity and quality of stormwater discharges produced by new development, redevelopment,

and activities at currently-developed properties, such that the discharges comply with state water quality standards and do not impair beneficial uses of the receiving waters. The state water quality standards include: Chapter 173-200 WAC, Water Quality Standards for Ground Waters of the State of Washington; Chapter 173-201A, Water Quality Standards for Surface Waters of the State of Washington; and Chapter 173-204, Sediment Management Standards.

This manual may also be helpful in identifying options for retrofitting BMPs as mitigation in areas of existing development. Stand-alone retrofitting projects may or may not fit neatly into the criteria and decision processes set forth in this manual. The developer is responsible in all cases to determine all applicable code and manual requirements.

It is not the intent of this manual to preclude alternative engineering solutions to design situations. It is expected that the professional engineer will bring to each project the best of his/her skills and abilities to see that the project is thoroughly analyzed and designed correctly, accurately, and in compliance with generally accepted engineering practices. Alternatives to standard plans, specifications, and design details found in this manual will be accepted if they meet or exceed the performance of these standards as determined by the county. Engineers are encouraged to be innovative. The burden of proof, however, is on the engineer to document that his/her innovations meet or exceed the performance of the standards.

This manual is based on the premise that development and redevelopment shall not negatively impact adjacent and/or downstream property owners nor degrades groundwater or the natural drainage system, including but not limited to streams, ravines, wetlands, potholes, and rivers. Further, development activities should not impact adjacent and/or downstream property owners in a detrimental manner compared to the predeveloped condition.

It is not the intent of this manual to make Snohomish County a guarantor or protector of public or private property with regards to land development activities. Through this manual, Snohomish County is complying in part with the Clean Water Act, the Puget Sound Water Quality Management Plan and the National Pollutant Discharge Elimination System (NPDES) Stormwater Permit. Where requirements in this document are also covered in any other law, ordinance, resolution, rule or regulation of any kind the more restrictive law shall govern.

1.2 Organization of the Snohomish County Drainage Manual

The Snohomish County Drainage Manual is divided into five volumes.

Volume I of this manual describes the requirements of Snohomish County code (SCC) that are satisfied by the use of this manual, including a detailed description of the nine Minimum Requirements set forth in Chapter 30.63A SCC. Volume I also sets forth the processes to determine appropriate BMPs to meet these requirements, and contains additional information and requirements referenced by Snohomish County code.

Volume II contains BMPs for stormwater management during and immediately following the period of construction or land disturbance. In the parlance of the construction industry, these BMPs are often referred to as erosion and sedimentation control BMPs, or ESC BMPs.

Volume III contains hydrologic analysis methods and BMPs to control flow volumes from developed sites. These BMPS are typically referred to as flow control BMPs.

Volume IV contains BMPs to prevent or minimize pollution generated by potential pollution sources at developed sites. These BMPs are typically referred to as source control BMPs.

Volume V contains BMPs to treat runoff that contains sediment or other pollutants from developed sites. These BMPs are typically referred to as treatment BMPs.

1.3 Organization of Volume I

Chapter 1 of this volume explains the contents of the volume and presents additional general information about stormwater, best management practices, and state and federal regulations that may apply to construction projects in Snohomish County (note: state and federal regulations are not administered by the County).

Chapter 2 of this volume describes the Minimum Requirements for stormwater control and site development for all new development and redevelopment in the county, as established in SCC 30.63A.300 and SCC 30.63A.310. This chapter also provides flow charts and additional explanatory information about how to determine the requirements applicable to any particular land disturbing activity or development project.

Chapter 3 of this volume contains detailed information about preparing stormwater site plans as required by SCC 30.63A.400 and SCC 30.63A.440.

Chapter 4 contains detailed information about the selection of flow control and stormwater treatment BMPs that may be required.

Specific information about the design and construction of required BMPs is contained in volumes II through V of this manual.

Appendices are included to support these topics. Volume I also includes a glossary for all five volumes of the stormwater manual.

1.4 How to Use this Manual

People who are applying to Snohomish County for a land development permit or drainage plan approval should read all of Chapter 1 and Chapters 2.1 through 2.4 of Volume I, in order to determine the Minimum Requirements applicable to the proposed project. Having determined the applicable requirements, applicants should read the chapters of this volume and Volumes II through V related to these requirements to determine the BMPs that will be used for the project.

Modifications and waivers of the requirements of this manual may be approved by Snohomish County according to SCC 30.63A.830 through SCC 30.63A.842.

People who are required by Chapter 7.53 SCC to implement source control BMPs at sites with existing development should read Volume IV and, for the control of erosion and sediment pollution, Volume II.

The Snohomish County Department of Planning and Development Services website has information on the county's land use permitting process, including online permit information. Permit information can also be obtained by calling 425-388-3411, or visiting the Planning and Development Services Permit Counter at 3000 Rockefeller Ave, Second Floor, Everett WA.

1.5 Development of Best Management Practices for Stormwater Management

1.5.1 Best Management Practices (BMPs)

Adverse impacts of development and redevelopment are prevented or minimized through the application of Best Management Practices (BMPs). BMPs are defined in Chapter 7.53 SCC as physical objects, structures, managerial practices, or behaviors, that, when used singly or in combination, eliminate or reduce the introduction of contaminants to stormwater, receiving waters, or groundwater. They are defined in Chapter 30.91 SCC as physical, structural, or managerial practices which have gained general acceptance for their ability to prevent or reduce public safety impacts and other environmental impacts, and which are adopted in the Snohomish County Drainage Manual, or approved by the director of planning and development services.

Generally speaking, BMPs can be categorized as erosion control BMPs, flow control BMPs, source control BMPs, and treatment BMPs. BMPs that involve construction of engineered structures are often referred to as facilities in this manual. For instance, the BMPs referenced in the menus of Chapter 3 in Volume V are called treatment facilities.

The primary purpose of using BMPs is to protect beneficial uses of water resources through the reduction of pollutant loads and concentrations, and through reduction of discharges (volumetric flow rates) causing stream channel erosion.

1.5.2 Source Control BMPs and Erosion and Sedimentation Control BMPs

Source control BMPs are defined specifically in Chapter 7.53 SCC as structures, equipment, supplies, or operations that are intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants. Source control BMPs to be used for compliance with Chapter 7.53 SCC and Chapter 30.63 SCC are set forth in Volume IV of this manual. Historically, erosion and sedimentation control (ESC) BMPs have been kept as a separate class, probably due to the fact that they have been required primarily through the regulation of construction and land development. However, many ESC BMPs are essentially source controls for a particular pollutant (sediment). Alternatively, a single BMP (such as covering exposed or stockpiled soil with mulch) could be considered an ESC BMP at a construction site and a source control BMP at an existing developed site with exposed soil.

1.5.3 Treatment BMPs

Treatment BMPs include facilities that remove pollutants by processes such as sedimentation, adsorption, filtration, biological uptake, and phytoremediation. Treatment BMPs can accomplish significant levels of pollutant load reductions if properly designed and maintained.

1.5.4 Flow Control BMPs

Flow control BMPs typically control the rate, frequency, and flow duration of stormwater surface runoff. The need to provide flow control BMPs depends on the size and type of the proposed project. Generally speaking, the amount of impervious surface in a development is the biggest factor in determining the amount of runoff generated. The primary means of controlling the stormwater flow that is generated are detention (slowing the flow rate of surface runoff), infiltration, and, to a lesser degree, evapotranspiration.

The concept of detention is to collect runoff from a developed area and release it at a slower rate than it enters the collection system. The reduced release rate requires temporary storage of the stormwater generated from the developed area. The volume of storage needed is dependent on 1) the size of the drainage area; 2) the extent of disturbance of the natural vegetation, topography, and soils and creation of effective impervious surfaces (surfaces that drain to a stormwater collection system); and 3) how rapidly the water is allowed to leave the detention pond, i.e., the target release rates.

The detention design standard in this manual is called a "flow duration" standard. Instead of matching the pre-development and post-development peak stormwater flow rates related to rainstorms of certain recurrence intervals, the flow duration standard requires matching, for predevelopment and postdevelopment conditions, the amount of time (the duration) at which specific flow rates are exceeded. For example, if one of the specific flow rates for a project is 100 gallons per minute, and modeling with many years of rainfall records indicated that this flow rate was exceeded 10% of the time in the predevelopment condition, the detention facility would need to be designed so that flow from the development does not exceed this duration statistic.

The flow duration standard typically results in significantly larger detention ponds than the previous "peak flow rate" standard set forth in the 1992 Ecology Stormwater Manual. However, the size of such a facility can be reduced by reducing the extent to which native vegetation and soil on a site are disturbed, reducing the amount impervious surface included in the development, and using low impact development (LID) BMPs. Some LID BMPs are included in this manual, and others can be incorporated into projects in Snohomish County provided that code requirements and standards are met.

Regulations for controlling stormwater discharges to wetlands are set forth in SCC 30.63A.570. The intent of these regulations is to avoid alteration of the natural hydroperiod of the wetland. This means control of flows from a development such that the wetland is within certain elevations at different times of the year and short-term elevation changes are within the prescribed limits.

1.6 Relationship of this Manual to Federal and State Regulatory Requirements

1.6.1 Introduction

This section describes some of the federal and state regulations and permits that may apply to a project depending on the nature of the project and site characteristics. Snohomish County does not have a direct role in implementing these regulations or permits, but county staff may be able to assist members of the public in determining the applicable regulations or permits apply and providing contact information for the appropriate regulatory agencies. Snohomish County has attempted to tailor its regulatory and permit requirements to match those of similar federal and state regulations and permits.

For some projects, the Joint Aquatic Resources Permit Application (JARPA) may streamline the environmental permitting process. As noted in the following sections, several of the permits described in this section are included in the JARPA, so they can be covered under a single permit application. Refer to the Access Washington e-permitting website for more information.

1.6.2 More Stringent Measures

Federal and state agencies may impose additional or more stringent BMPs to meet state water quality standards or other established natural resource or drainage objectives, such as those established in Total Maximum Daily Loads (TMDLs) and pursuant Water Cleanup Plans.

1.6.3 Retrofitting

This Manual is not a retrofit manual, but it can be helpful in identifying options for retrofitting BMPs in areas or sites with existing development. Retrofitting stormwater BMPs into existing developed areas may be necessary to meet federal Clean Water Act and state Water Pollution Control Act (Chapter 90.48 RCW) requirements. In retrofit situations there frequently are site constraints that make the strict application of BMPs difficult. In these instances, the BMPs presented here can be modified using best professional judgment to provide reasonable improvements in stormwater management.

1.6.4 NPDES Industrial Stormwater General Permit

Many businesses in Snohomish County are subject to the NPDES Industrial Stormwater General Permit. Information about this permit may be obtained on the Washington State Department of Ecology.

This permit requires preparation and implementation of a Stormwater Pollution Prevention Plan. The BMPs in Volume IV of this manual should be adequate for compliance with the industrial stormwater permit, but operators of businesses subject to that permit should verify requirements of that permit with Ecology.

1.6.5 NPDES Construction Stormwater General Permit

Construction sites that disturb one acre or more and discharge stormwater from the project site to surface water are regulated by the NPDES Construction Stormwater General Permit. Information about this permit may be obtained from the Washington State Department of Ecology.

As with the industrial stormwater permit discussed in Section 1.6.4 above, the BMPs in this manual should be adequate for compliance with the construction stormwater permit, but operators of projects subject to that permit should verify requirements of that permit with Ecology.

1.6.6 Endangered Species Act

With the listing of multiple species of salmon as threatened or endangered across much of Washington State, and the probability of more listings in the future, implementation of the requirements of the Endangered Species Act may have a dramatic effect on urban stormwater management. Provisions of the Endangered Species Act that may apply directly to stormwater management include the Section 4(d) rules, Section 7 consultations, and Section 10 Habitat Conservation Plans (HCPs), which can affect the regulations of local governments and in some cases can be imposed on individual projects directly.

1.6.7 Section 401 Water Quality Certifications

For projects that require a fill or dredge permit under Section 404 of the Clean Water Act, Ecology must certify to the U.S. Army Corps of Engineers that the proposed project will not violate water quality standards. In order to make such a determination, Ecology may do a more specific review of the potential impacts of a stormwater discharge from the construction phase of the project and from the completed project. As a result of that review, Ecology may condition its certification to require:

- Application of the minimum requirements and BMPs in the latest version of its Stormwater Management manual; or
- Application of more stringent requirements.

1.6.8 Hydraulic Project Approvals (HPAs)

Under Chapter 77.55 RCW, the Hydraulics Act, the Washington State Department of Fish and Wildlife (DFW) has the authority to require actions when stormwater discharges related to a project would change the natural flow or bed of state waters. The implementing mechanism is the issuance of a Hydraulics Project Approval (HPA) permit. In exercising this authority, DFW may require:

- Compliance with the provisions of the latest version of Ecology's Stormwater Management Manual; or
- Application of more stringent requirements that DFW determines are necessary to meet their statutory obligations to protect fish and wildlife.

1.6.9 Aquatic Lands Use Authorizations

The Department of Natural Resources (DNR), as the steward of public aquatic lands, may require a stormwater outfall to have a valid use authorization, and to avoid or mitigate resource impacts. Through its use authorizations, which are issued under authority of Chapter 79.90 through 96, and in accordance with Chapter 332-30 WAC, DNR may require:

- Compliance with the provisions of the latest version of Ecology's Stormwater Management Manual; or
- Application of more stringent requirements that they determine are necessary to meet their statutory obligations to protect the quality of the state's aquatic lands.

1.6.10 Underground Injection Control Authorizations

To implement provisions of the federal Safe Drinking Water Act, Ecology has adopted rules (Chapter 173-218 WAC) for an underground injection control (UIC) program. Depending upon the manner in which it is accomplished, the discharge of stormwater into the ground can be classified as a Class V injection well. Federal UIC regulations, 40 CFR Part 144, were revised in 2000 to include subsurface distribution systems, drywells, catch basins, and similar devices that discharge to the ground. To date, Ecology's activity under this program has been primarily in regard to registering UIC wells.

Chapter 2 - Minimum Requirements for New Development and Redevelopment

Chapter 30.63A SCC sets forth nine Minimum Requirements for new development and redevelopment projects. Some projects are exempt from these requirements, and the exemptions are set forth in Chapter 30.63A SCC Part 200.

The Minimum Requirements are:

1) preparation of a stormwater site plan
2) stormwater pollution prevention plan (SWPPP)
3) water pollution source control for new development or redevelopment activities
4) preservation of natural drainage systems or outfalls for all new development and redevelopment
5) on-site stormwater management
6) runoff treatment
7) flow control requirements for new development or redevelopment
8) detention in wetlands and wetland buffers
9) inspection, operation and maintenance requirements

Depending on the type and size of the proposed project, different combinations of these minimum requirements apply.

2.1 [reserved]

2.2 Exemptions

Chapter 30.63A SCC Part 200 sets forth exemptions from Minimum Requirements for some land disturbing activities and types of development projects. Some projects and activities are exempt from all Minimum Requirements, and others are exempt from all Minimum Requirements except Minimum Requirement 2 - Stormwater Pollution Prevention Plan. People who are applying to Snohomish County for a land development permit or drainage plan approval should carefully read the referenced code sections to determine the applicable Minimum Requirements.

Supplemental information regarding exemptions for road maintenance activities

The following road maintenance practices are considered redevelopment, and therefore are not categorically exempt from Minimum Requirements. The extent to which the manual applies is explained for each circumstance.

- Removing and replacing a paved surface to base course or lower, or repairing the roadway base If impervious surfaces are not expanded, Minimum Requirements #1 - #5 apply. Where appropriate, project proponents are encouraged to look for opportunities to use permeable and porous pavements.

- Extending the pavement edge without increasing the size of the road prism, or paving graveled shoulders These activities are considered new impervious surfaces and are subject to the minimum requirements that are triggered when the thresholds identified for redevelopment projects are met.
- Resurfacing by upgrading from dirt to gravel, asphalt, or concrete; upgrading from gravel to asphalt, or concrete; or upgrading from a bituminous surface treatment ("chip seal") to asphalt or concrete These activities are considered new impervious surfaces and are subject to the minimum requirements that are triggered when the thresholds identified for redevelopment projects are met.

2.3 Definitions Related to Minimum Requirements

This section presents a list of definitions related to the Minimum Requirements presented in this volume. A complete glossary for the Snohomish County Drainage Manual is presented at the end of this volume. In the event of a discrepancy between a definition for a term in Chapter 30.9 SCC and a definition for the same term in this manual, the definition found in Chapter 30.9 SCC takes precedence.

"**Effective impervious surface"** means the portion of impervious surface producing runoff that cannot be infiltrated and upon which runoff cannot infiltrate, and that is connected via sheet flow or discrete conveyance to a drainage system. Impervious surfaces on residential development sites are considered ineffective if the runoff is dispersed through at least one hundred feet of native vegetation in accordance with BMP T5.30 in volume V, Chapter 5 of Volume V of the Drainage Manual. (See Chapter 30.91E SCC).

"Impervious surface" means a hard surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development. A hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roofs, walkways, patios, driveways, parking lots, storage areas, concrete or asphalt paving, graveled areas and roads, packed earthen materials, and oiled, macadam, asphalt treated base material (ATB), bituminous surface treatment (BST), chip seal, seal coat or emulsified asphalt and cutback asphalt cement, or other surfaces which similarly impede the natural infiltration of stormwater. Open, uncovered retention/detention facilities shall not be considered as impervious surfaces for purposes of determining whether the thresholds for application of minimum stormwater management requirements are exceeded pursuant to Chapter 30.63A SCC. However, open, uncovered retention/detention facilities shall be considered impervious surfaces for purposes of runoff modeling. (See Chapter 30.91I SCC).

"Land disturbing activity" means any activity that will result in movement of earth, or a change in the existing soil cover (both vegetative and non-vegetative) and/or the existing soil topography (both vegetative and non-vegetative), including the creation and/or replacement of impervious surfaces. Land disturbing activities include, but are not limited to clearing and grading. Compaction that is associated with stabilization of structures and road construction shall

also be considered a land disturbing activity. Vegetation maintenance practices are not considered land-disturbing activity. (See Chapter 30.91L SCC).

"Maintenance" means activities conducted on currently serviceable structures, facilities, and equipment that involves no expansion or use beyond that previously existing and results in no significant adverse hydrologic impact. It includes those usual activities taken to prevent a decline, lapse, or cessation in the use of structures and systems. Those usual activities may include replacement of dysfunctional facilities, including cases where environmental permits require replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are not changed. This does not include expansion in physical dimension, capacity or use. (See Chapter 30.91M SCC).

"Native vegetation" means vegetation comprised of plant species, other than noxious weeds, that are indigenous to the coastal region of the Pacific Northwest and which reasonably could have been expected to naturally occur on the site. Examples include, but are not limited to trees such as douglas fir, western hemlock, western red cedar, alder, big leaf maple, and vine maple; shrubs such as willow, elderberry, salmonberry, and salal; and herbaceous plants such as sword ferns, foam flower, and fireweed. (See Chapter 30.91N).

"New development" means the following land disturbing activities: Class IV -general forest practices that are conversions from timber land to other uses; structural development, including construction or installation of a building or other structure; creation of impervious surfaces; and subdivisions, short subdivisions, residential condominiums, single-family detached units (SFDU), duplexes, residential condominiums, planned residential developments (PRD) and binding site plans. Projects meeting the definition of redevelopment shall not be considered new development. (See Chapter 30.91N SCC).

"Pollution-generating impervious surface (PGIS)" means those impervious surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces include those which are subject to: vehicular use; industrial activities; or storage of erodible or leachable materials, wastes, or chemicals; and which receive direct rainfall or the runon or blow-in of rainfall. Erodible or leachable materials, wastes, or chemicals are those substances which, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff and are PGIS. Examples include, but are not limited to erodible soils that are stockpiled, uncovered process wastes, manure, fertilizers, oily substances, ashes, kiln dust, and garbage dumpster leakage. Metal roofs are also considered PGIS unless they are coated with an inert, non-leachable material such as baked-on enamel coating. The following are considered regularly-used by motor vehicles: roads, unvegetated road shoulders, bike lanes within the traveled lane of a roadway, driveways, parking lots, unfenced fire lanes, vehicular equipment storage yards, and airport runways. A surface, whether paved or not, shall be considered subject to vehicular use if it is regularly used by motor vehicles. The following surfaces are not considered regularly-used by motor vehicles: paved bicycle pathways separated from and not subject to drainage from roads for motor vehicles, fenced fire lanes, and infrequently used maintenance access roads. (See Chapter 30.91P SCC).

“Pollution-generating pervious surfaces (PGPS)” means any non-impervious surface subject to use of pesticides and fertilizers or loss of soil. Typical PGPS include lawns, landscaped areas, golf courses, parks, cemeteries, and sports fields. (See Chapter 30.91P SCC).

“Predeveloped condition” means fully-forested condition (soils and vegetation) of second-growth forest to which an Ecology-approved continuous runoff hydrologic model is calibrated, unless reasonable, historic information is provided that indicates the site was prairie prior to Euro-American settlement. (See Chapter 30.91P SCC).

“Project site” means that portion of a property, properties, or right of way subject to land disturbing activities, new impervious surfaces, or replaced impervious surfaces. (See Chapter 30.91P SCC).

“Receiving waters” means bodies of water or surface water systems to which surface runoff is discharged via a point source of stormwater or via sheet flow. (See Chapter 30.91R SCC).

"Redevelopment" means the following activities that take place on a site that already has 35 percent or more existing impervious surface coverage. The creation of new impervious surface(s); structural development including construction, installation, expansion or replacement of a building footprint or other structure, replacement of existing impervious surface that is not maintenance, and land disturbing activity. The following activities are considered maintenance and therefore are not redevelopment: trenching; utility installation; road and sidewalk projects overlaying existing pavement; and construction that reduces and repairs impervious surfaces. (See Chapter 30.91R SCC).

“Replaced impervious surface” means, for structures, the removal of impervious surfaces and replacement of any exterior impervious surfaces or foundation for other impervious surfaces, or the removal down to bare soil or base course and the replacement with other impervious surfaces. See Chapter 30.91R SCC).

"Site" means the area defined by the legal boundaries of a parcel or parcels of land that is (are) subject to new development or redevelopment, including contiguous improvements in the right of way. For road projects, the length of the project site and right-of-way boundaries define the site. (See Chapter 30.91S SCC).

“Source control best management practice” means structures, equipment, supplies or operations intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants. (See Chapter 39.01S SCC).

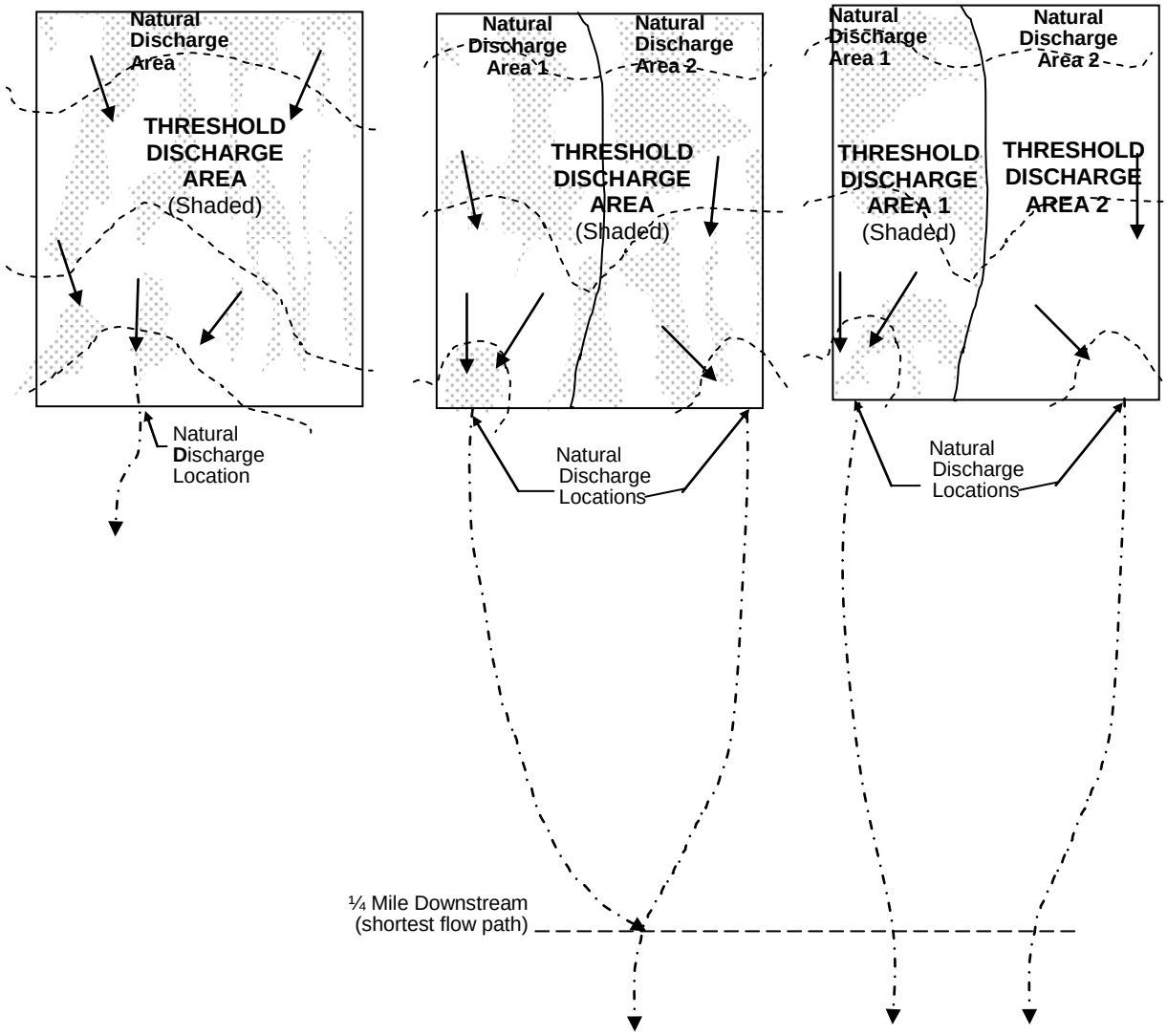
"Threshold discharge area” means an on-site area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream as determined by the shortest flowpath. (See Chapter 30.91T SCC).

Figure 2.1 Threshold Discharge Areas

Project Site with a Single Natural Discharge and a Single Threshold Discharge Area

Project Site with Multiple Natural Discharges and a Single Threshold Discharge Area

Project Site with Multiple Natural Discharges and Multiple Threshold Discharge Areas



2.4 Applicability of the Minimum Requirements

SCC 30.63A.300 and SCC30.63A310 set forth the applicability of the Minimum Requirements to different types of development and redevelopment projects. Figures 2.2 through 2.4 illustrate this applicability in a summary manner. However, people who are applying to Snohomish County for a land development permit or drainage plan approval should carefully read the referenced code chapter to determine the applicable Minimum Requirements.

Note: the requirements set forth in bold text in Figures 2.2 through 2.4 are additive; later requirements do not replace earlier requirements, but add to them.

Figure 2.2 Minimum Requirements (MR's) for New Development Projects

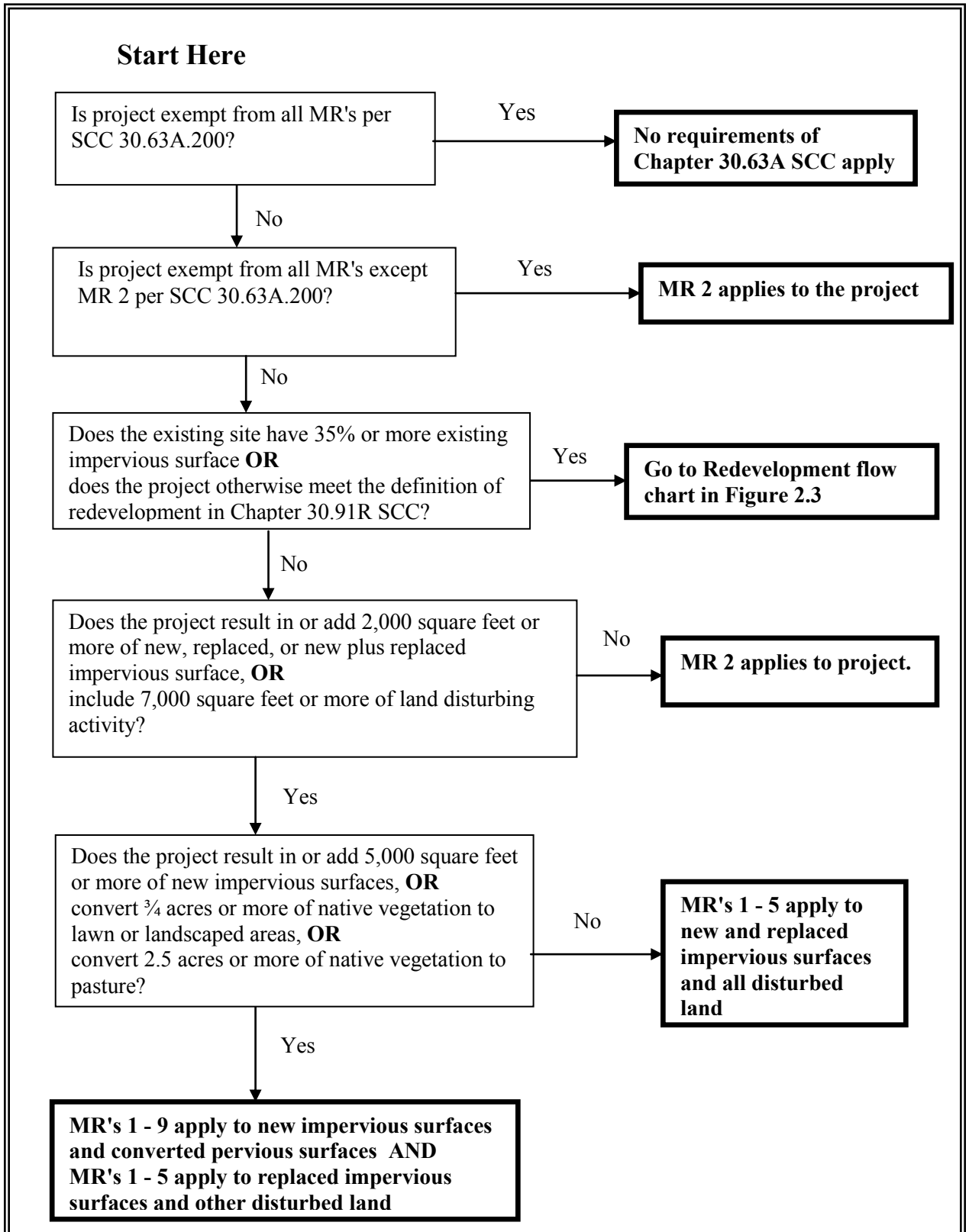


Figure 2.3 Minimum Requirements (MR's) for Redevelopment Projects

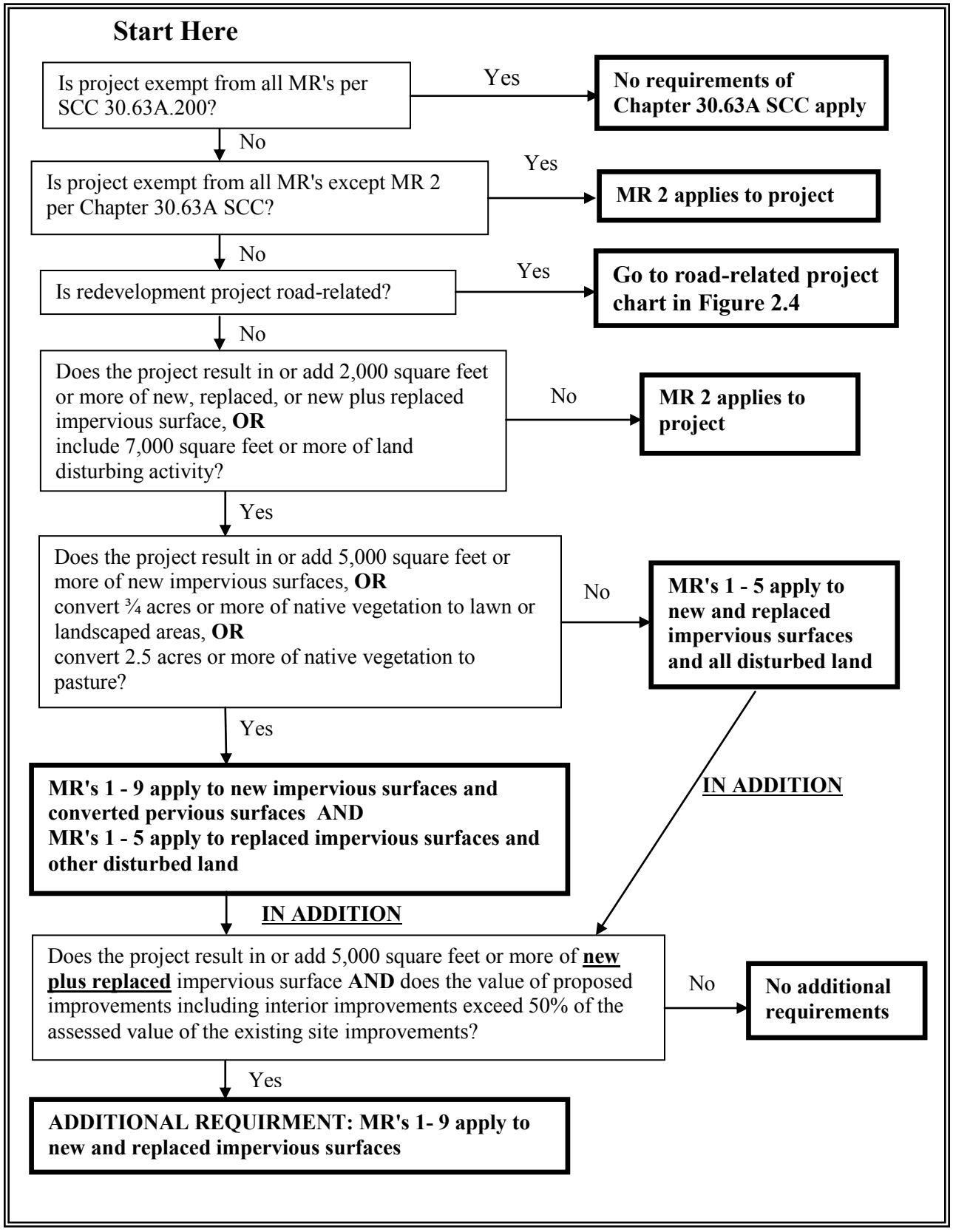
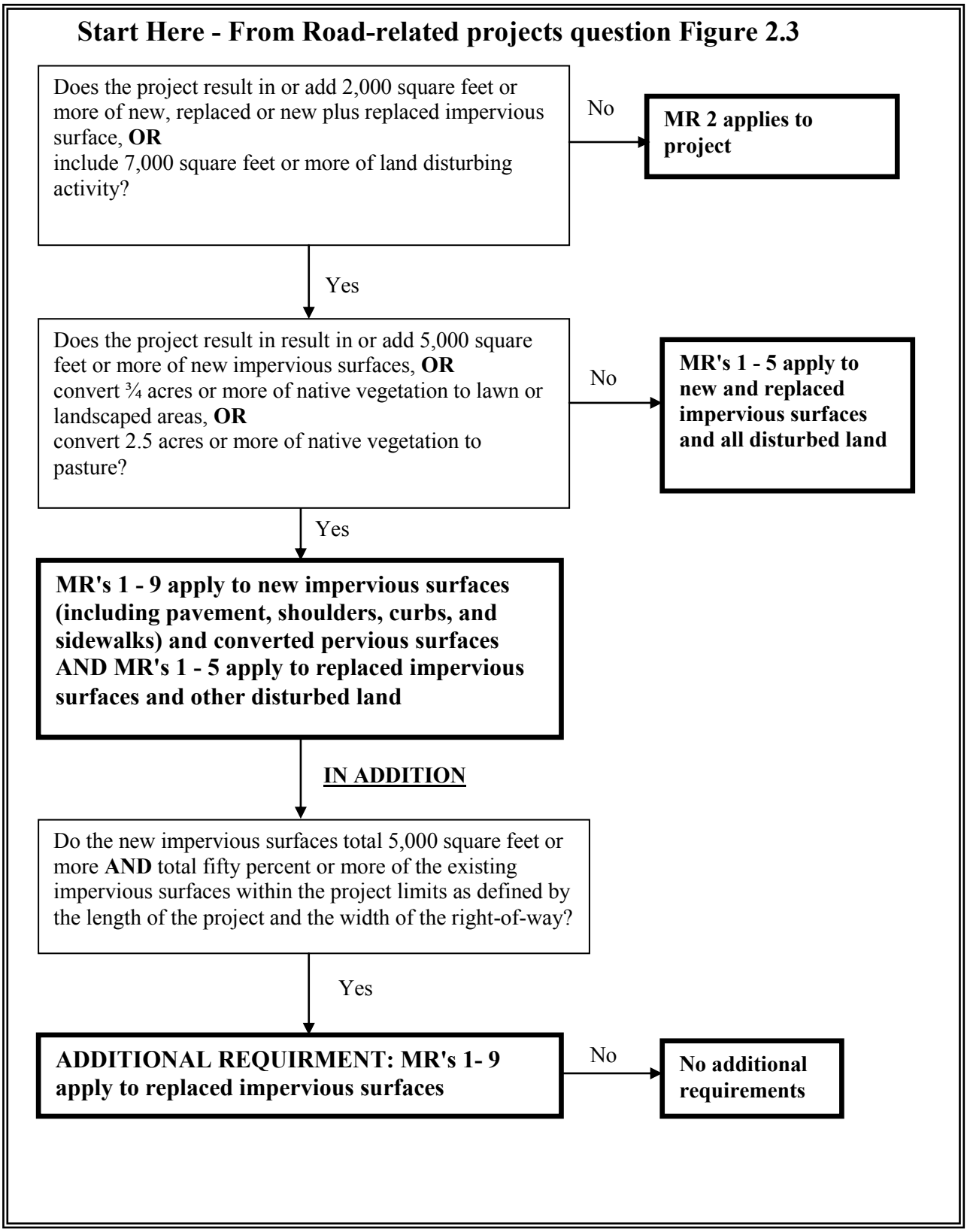


Figure 2.4 Minimum Requirements (MR's) for Road-related Redevelopment Projects



2.5 Minimum Requirements

Chapter 30.63A SCC Parts 400 through 600 establish Minimum Requirements for development and redevelopment projects. In some cases, the codes refer to the sections below, which contain specific details.

2.5.1 Minimum Requirement #1: Preparation of Stormwater Site Plans

SCC 30.63A.400 through SCC 30.63A.440 contain requirements pertaining to preparation of Stormwater Site Plans.

The following requirements specifically address off-site analysis required in SCC 30.63A.420.

Development projects that discharge stormwater offsite shall submit an offsite analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project and that proposes appropriate mitigation of those impacts. The existing or potential impacts to be evaluated and mitigated shall include:

- Conveyance system capacity problems;
- Localized flooding;
- Upland erosion impacts, including landslide hazards;
- Stream channel erosion at the outfall location;
- Violations of surface water quality standards as identified in a Basin Plan or a TMDL Water Clean-up Plan; or violations of ground water standards in a wellhead protection area.

Projects shall initially submit, with the permit application, a qualitative analysis of each downstream system to which the project discharges. The analysis should accomplish four tasks:

Task 1 – Define and map the study area

Submission of a site map showing property lines; a topographic map (at a minimum a USGS 1:24000 Quadrangle Topographic map) showing site boundaries, study area boundaries, downstream flowpath, and potential/existing problems.

Task 2 – Review all available information on the study area

This review should include all available basin plans, ground water management area plans, drainage studies, FEMA flood insurance rate maps, wetlands inventory maps, critical areas maps, stream habitat reports, salmon distribution reports, etc.

Task 3 – Field inspect the study area

The design engineer should physically inspect the existing onsite and offsite drainage systems of the study area for each discharge location for existing or potential problems and drainage features. An initial inspection and investigation should include:

- Investigate problems reported or observed during the resource review
- Locate existing or potential constrictions or capacity deficiencies in the drainage system

- Identify existing or potential flooding problems
- Identify existing or potential overtopping, scouring, bank sloughing, or sedimentation
- Identify significant destruction of aquatic habitat (e.g., siltation or stream incision)
- Collect qualitative data on features such as land use, impervious surface, topography, soils, presence of streams, and wetlands
- Collect information on pipe sizes, channel characteristics, and drainage structures
- Verify tributary drainage areas identified in Task 1
- Contact local governments, neighboring property owners, and residents about drainage problems
- Note date and weather at time of inspection

Task 4 – Describe the drainage system, and its existing and predicted problems

For each drainage system component (e.g., pipe, culvert, bridge, outfall, pond, vault) the following should be covered in the analysis: location, physical description, problems, and field observations.

All existing or potential problems (e.g., ponding water, erosion) identified in Tasks 2 and 3 above should be described. The descriptions should be used to determine whether adequate mitigation can be identified, or whether more detailed quantitative analysis is necessary. The following information should be provided for each existing or potential problem:

- Magnitude of or damage caused by the problem
- General frequency and duration
- Return frequency of storm or flow when the problem occurs (may require quantitative analysis)
- Water elevation when the problem occurs
- Names and concerns of parties involved
- Current mitigation of the problem
- Possible cause of the problem
- Whether the project is likely to aggravate the problem or create a new one.

Upon review of this analysis, the director may require mitigation measures deemed adequate for the problems, or a quantitative analysis, depending upon the presence of existing or predicted flooding, erosion, or water quality problems, and on the proposed design of the onsite drainage facilities. The analysis should repeat Tasks 3 and 4 above, using quantitative field data including profiles and cross-sections.

The quantitative analysis should provide information on the severity and frequency of an existing problem or the likelihood of creating a new problem. It should evaluate proposed mitigation intended to avoid aggravation of the existing problem and to avoid creation of a new problem.

2.5.2 Minimum Requirement #2: Stormwater Pollution Prevention Plans (SWPPPs)

SCC 30.63A.445 through SCC 30.63A.510 contain requirements for development and implementation of Stormwater Pollution Prevention Plans (SWPPPs). Requirements for specific SWPPP elements are in the following code sections.

- SCC 30.63A.455 SWPPP element 1: preserve vegetation/mark clearing limits.
- SCC 30.63A.460 SWPPP element 2: establish construction access
- SCC 30.63A.465 SWPPP element 3: control flow rates
- SCC 30.63A.470 SWPPP element 4: install sediment controls
- SCC 30.63A.475 SWPPP element 5: stabilize soils
- SCC 30.63A.480 SWPPP Element 6: protect slopes
- SCC 30.63A.485 SWPPP element 7: protect permanent drain inlets
- SCC 30.63A.490 SWPPP element 8: stabilize channels and outlets
- SCC 30.63A.495 SWPPP element 9: control pollutants
- SCC 30.63A.500 SWWP element 10: control dewatering
- SCC 30.63A.505 SWPPP element 11: maintain best management practices.
- SCC 30.63A.510 SWPPP element 12: manage the project

2.5.3 Minimum Requirement #3: Source Control of Pollution

SCC 30.63A.515 contains requirements for water pollution source control for new development or redevelopment activities.

2.5.4 Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

SCC 30.63A.520 contains requirements for preservation of natural drainage systems or outfalls for all new development and redevelopment activities

2.5.5 Minimum Requirement #5: On-site Stormwater Management

SCC 30.63A.525 contains requirements for on-site stormwater management.

2.5.6 Minimum Requirement #6: Runoff Treatment

SCC 30.63A.530 through SCC30.63A.545 contain requirements for runoff treatment controls.

Impervious surfaces that are "fully dispersed" in accordance with BMP T5.30 in Volume V are not considered effective impervious surfaces. PGIS surfaces that are "dispersed" in accordance with the BMPs in Section 5.1 of Volume V are considered effective impervious surfaces. Porous pavers and modular grid pavements are assigned a lower curve number (if using single event hydrology to size wetpools) and lower surface runoff calibrations (if using continuous runoff modeling). See Volume III for a more complete description of hydrologic credits for Onsite Stormwater Management BMPs.

2.5.7 Minimum Requirement #7: Flow Control

SCC 30.63A.550 through SCC 30.63A.565 contain requirements for flow control for new development and redevelopment.

2.5.8 Minimum Requirement #8: Wetlands Protection

SCC 30.63A.570 contains requirements for detention or treatment in wetlands and wetland buffers.

2.5.9 Minimum Requirement # 9: Operation and Maintenance

SCC 30.63A.575 through SCC 30.63A.605 contain requirements for inspection, operation and maintenance of stormwater facilities and BMPs. Maintenance standards and additional specific requirements are contained in Volume V, Chapter 4 of this manual. In addition to the requirements in Chapter 30.63A SCC, SCC 7.53.140 requires owners and operators of drainage facilities to inspect and maintain them in accordance with the standards set forth in Volume V.

Chapter 3 - Preparation of Stormwater Site Plans

SCC 30.63A.410 through SCC 30.63A.440 contain requirements for preparation of Stormwater Site Plans. The Stormwater Site Plan is the comprehensive report containing all of the technical information and analysis necessary for regulatory agencies to evaluate a proposed new development or redevelopment project for compliance with stormwater requirements. Contents of the Stormwater Site Plan will vary with the type and size of the project, and individual site characteristics.

The scope of the Stormwater Site Plan also varies depending on the applicability of Minimum Requirements (see Section 2.4 of this Volume).

Chapter 4 - BMP and Facility Selection Process for Permanent Stormwater Control Plans

4.1 Purpose

SCC 30.63A.430 requires the preparation of a permanent stormwater control plan. This chapter (Volume 1, Chapter 4) shall be used to select stormwater control BMPs and facilities that will serve the project site in its developed condition. The requirements for preparing a Stormwater Pollution Prevention Plan are set forth in SCC 30.63A.445 through SCC 30.63A.510.

4.2 BMP and Facility Selection Process

Step 1: Determine and Read the Applicable Minimum Requirements set forth in Snohomish County code.

SCC 30.63A.300 through SCC 30.63A.310 set forth the Minimum Requirements applicable to different projects. Figures 2.2, 2.3, and 2.4 of this volume provide the same information in a flow chart format.

Step 2: Select Source Control BMPs

Note: If your project is a residential development, you may skip this step.

Refer to Volume IV of this manual. If the project involves construction of areas or facilities to conduct any of the activities described in Volume IV, Chapter 5, the applicable structural source control BMPs described in that section must be constructed as part of the project.

The project may have additional source control responsibilities as a result of area-specific pollution control plans (e.g., watershed or basin plans, water clean-up plans, groundwater management plans, and lakes management plans).

Step 3: Determine Threshold Discharge Areas and Applicable Requirements for Treatment, Flow Control, and Wetlands Protection

SCC 30.63A.530 through SCC 30.63A.565 establish size thresholds that determine the applicability of these requirements. SCC 30.63A.570 uses the size thresholds set forth in SCC 30.63A.530 through SCC 30.63A.565 to protect wetlands. Those thresholds determine whether certain areas (called "threshold discharge areas") of a project must use treatment and flow control facilities and whether on-site stormwater management BMPs can be applied per SCC 30.63A.525.

Step 3a**:** Read the definitions in Section 2.3 of this volume for the following terms: effective impervious surface, impervious surface, pollution-generating impervious surface (PGIS), pollution-generating pervious surface (PGPS), and threshold discharge area.

Step 3b**:** Outline the threshold discharge areas for your project site.

Step 3c**:** Determine the amount of effective pollution-generating impervious surfaces and pollution-generating pervious surfaces in each threshold discharge area. Compare those totals to the categories in SCC 30.63A.530 through SCC 30.63A.545 to determine where treatment facilities are necessary.

Step 3d**:** Determine the amount of effective impervious surfaces and converted pervious surfaces in each threshold discharge area. Using an approved continuous runoff simulation model, estimate the increase in the 100-year flow frequency within each threshold discharge area.

Compare those totals to the categories in SCC 30.63A.550 through SCC 30.63A.565 to determine where flow control facilities are necessary.

Step 4: Select Flow Control BMPs and Facilities

A determination should have already been made whether the requirements of SCC 30.63A.550 through SCC 30.63A.560 and SCC 30.63A.570 apply to the project site. If so, flow control facilities must be provided for discharges from those threshold discharge areas that exceed the thresholds set forth SCC 30.63A.550 through SCC 30.63A.565. In addition, non-pollution-generating impervious surface (NPGIS) runoff control BMPs from Volume III, Chapter 3 and pollution-generating impervious surface (PGIS) dispersion BMPs from Volume V, Chapter 5 must be implemented in accordance with SCC 30.63A.525. The requirements of SCC 30.63A.550 through SCC 30.63A.565 and the details in Volume III, Chapter 3 shall be used to size and design the required flow control BMPs, but in many cases hydrologic modeling credits for the NPGIS runoff control BMPs and PGIS dispersion BMPs will reduce the size of the flow control BMPs.

The following describes a selection process for facilities to meet SCC 30.63A.550 through SCC 30.63A.570.

Step 4a: Determine whether stormwater infiltration can be used.

There are two possible options for infiltration.

The first option is to infiltrate through rapidly draining soils that do not meet the site characterization and site suitability criteria for providing adequate treatment. See Volume III, Chapter 3 for design criteria for infiltration facilities intended to provide flow control without treatment. In this case, a treatment facility must be provided prior to discharge to the ground for infiltration. The treatment facility could be located off-line with a capacity to treat the water quality design flow rate or volume to the applicable performance goal. Volumes or flow rates in excess of the design volume or flow rate would bypass untreated into the infiltration basin. Note that wetpool treatment facilities are always designed to be on-line. The infiltration facility must provide adequate volume such that the flow duration standard of SCC 30.63A.550, or the water surface elevation requirements of SCC 30.63A.570 will be achieved.

The second option is to infiltrate through soils that meet the site characterization and site suitability criteria in Volume III, Chapter 3. The facility would be designed to meet the requirements for treatment and flow control.

If infiltration facilities for flow control are planned, the flow control requirement has been met; proceed to Step 5. If infiltration facilities are not planned, proceed to Step 4b.

Step 4b**:** Use the Western Washington Hydrology Model to size a detention facility.

Refer to Volume III, Chapter 2, for an explanation of the use of the Western Washington Hydrology Model. Note that the more the site is left undisturbed, and the less impervious surfaces are created, the smaller the detention facility. Additional incentives are given within the model for reducing the disruption of the natural hydrology.

Step 5: Select Treatment Facilities

Use SCC 30.63A.530 through SCC 30.63A.545, Figure 4.1 and the step-by-step process outlined below to determine the type of treatment facilities applicable to the project.

Step 5a**:** Determine the receiving waters and pollutants of concern based on offsite analysis.

Determine the natural receiving waters (e.g., ground water, wetland, lake, stream, salt water) for the stormwater drainage from the project site. If the discharge is to the Snohomish County storm drainage system, the receiving waters for the drainage system must be determined.

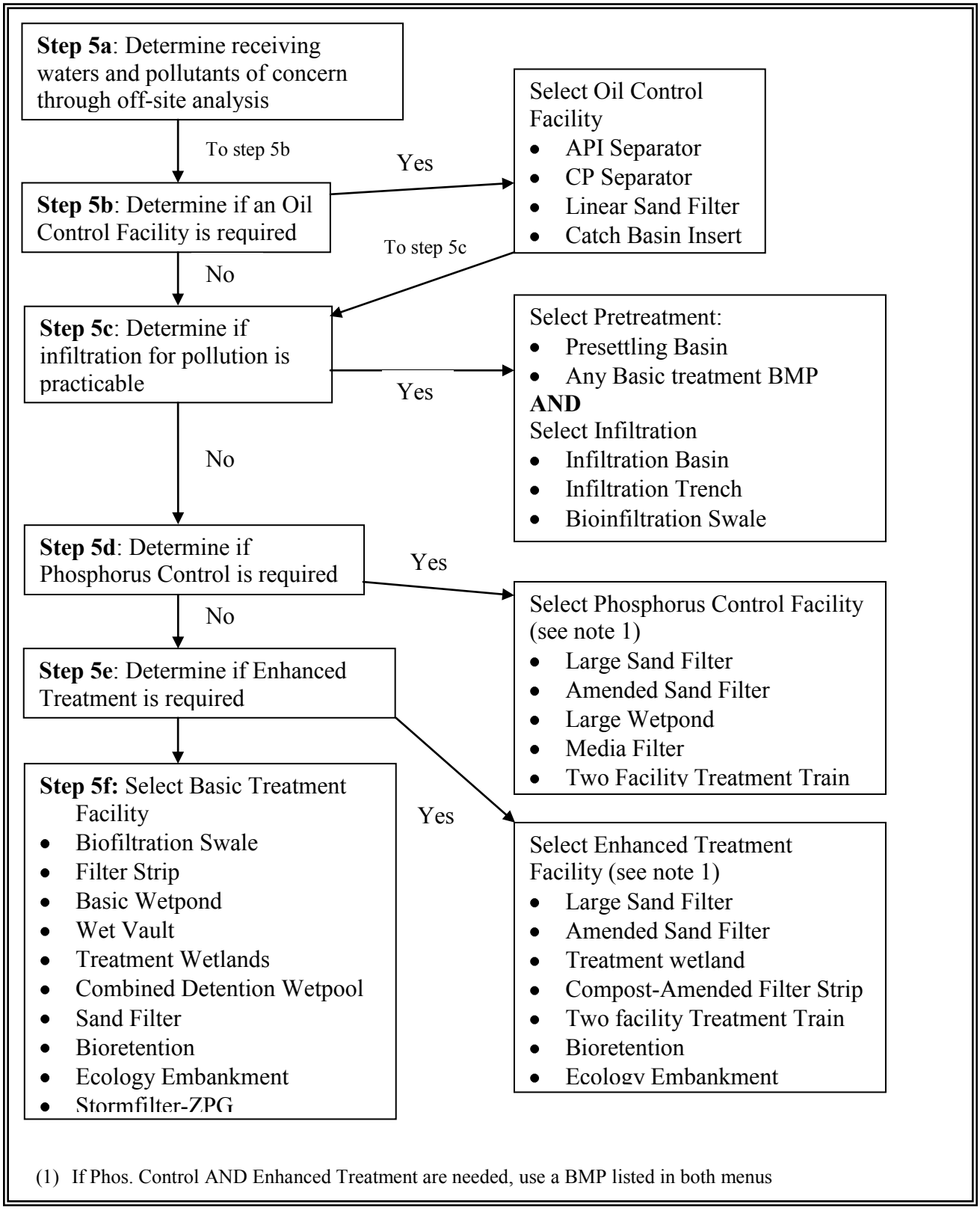
Step 5b: Determine if an oil control facility is required

Oil control facilities are required for projects that have "high-use sites." High-use sites are those that typically generate high concentrations of oil due to high traffic turnover or the frequent transfer of oil. High-use sites include:

- An area of a commercial or industrial site subject to an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area;
- An area of a commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year, not including routinely delivered heating oil;
- An area of a commercial or industrial site subject to parking, storage or maintenance of 25 or more vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.);
- A road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.

The traffic count can be estimated using information from "Trip Generation," published by the Institute of Transportation Engineers, or from a traffic study prepared by a professional engineer or transportation specialist with experience in traffic estimation.

Figure 4.1 Treatment Facility Selection Flow Chart



Some land use types require the use of a spill control (SC-type) oil/water separator. Those situations are described in Volume IV and are separate from this treatment requirement. While a number of activities may be required to use spill control (SC-type) separators, only a few will necessitate American Petroleum Institute (API) or coalescing plate (CP)-type separators for treatment. The following urban land uses are likely to have areas that fall within the definition of "high-use sites" or have sufficient quantities of free oil present that can be treated by an API or CP-type oil/water separator.

- Industrial Machinery and Equipment, and Railroad Equipment Maintenance
- Log Storage and Sorting Yards
- Aircraft Maintenance Areas
- Railroad Yards
- Fueling Stations
- Vehicle Maintenance and Repair
- Construction Businesses (paving, heavy equipment storage and maintenance, storage of petroleum products)

For high-use sites located within a larger commercial center, only the impervious surface associated with the high-use portion of the site is subject to treatment requirements. If common parking for multiple businesses is provided, treatment shall be applied to the number of parking stalls required for the high-use business only. However, if the treatment collection area also receives runoff from other areas, the treatment facility must be sized to treat all water passing through it.

High-use roadway intersections shall treat lanes where vehicles accumulate during the signal cycle, including left and right turn lanes and through lanes, from the beginning of the left turn pocket. If no left turn pocket exists, the treatable area shall begin at a distance equal to three car lengths from the stop line. If runoff from the intersection drains to more than two collection areas that do not combine within the intersection, treatment may be limited to any two of the collection areas.

If an oil control facility is required, select one of the options below.

- API-Type Oil/Water Separator – See Volume V, Chapter 11
- Coalescing Plate Oil/Water Separator – See Volume V, Chapter 11
- Linear Sand Filter – See Volume V, Chapter 8

The linear sand filter is used in the basic, enhanced, and phosphorus Treatment menus also. If used to satisfy one of those treatment requirements, the same facility shall not also be used to satisfy the oil control requirement unless quarterly maintenance is assured.

Step 5c: Determine whether infiltration for pollutant removal is practicable

Criteria for determining whether native soils are suitable for treating stormwater by infiltration are found in Volume III, Chapter 3.3.7, Site Suitability Criterion SSC-6. Infiltration can be effective at treating stormwater runoff, but soil properties must be appropriate to achieve effective treatment while not adversely impacting ground water resources. The location and depth to bedrock, the water table, or impermeable layers (such as glacial till), and the proximity to wells, foundations, septic tank drainfields, and unstable slopes can preclude the use of infiltration. Infiltration treatment facilities must be preceded by a pretreatment facility (see Volume V, Chapter 6), which may be a presettling basin, an oil control facility, or a basic treatment facility. If an oil/water separator is used for pretreatment, more frequent facility inspections may be necessary to determine when accumulated solids exceed the sediment depth at which maintenance is required (See Volume V, Chapter 4).

If infiltration treatment is practicable, select an infiltration facility and an appropriate pretreatment facility, and proceed to Step 5g.

If infiltration treatment is not practicable, proceed to Step 5d.

Step 5d: Determine if a phosphorus control facility is required.

SCC 30.63A.530 requires control of phosphorus in new development or redevelopment prior to:

- surface discharge to waters reported under section 305(b) of the Clean Water Act and designated as not supporting beneficial uses due to phosphorus;
- surface discharge to water bodies those waters listed in Washington State's Nonpoint Source Assessment required under section 319(a) of the Clean Water Act because of nutrient concentrations;
- surface discharge to priority peat wetlands; or
- stormwater infiltrated within one-quarter mile of a lake in soils that do not meet the soil suitability criteria in Chapter 3 of Volume III.

If phosphorus control is required, select one of the facilities below.

- Infiltration through soils meeting the minimum site suitability criteria for infiltration treatment.

- Infiltration through soils that do not meet the minimum site suitability criteria for infiltration treatment, preceded by a basic treatment facility, provided that the infiltration site is not within ¼ mile of a phosphorus-sensitive receiving water or a tributary to that water.

- Large sand filter

- Large wetpond

- Media filter targeted for phosphorus removal

- Amended sand filter

- Treatment train for phosphorus removal – see Table 4.1

The applicant may also check with the Washington State Department of Ecology to determine whether other BMPs that have been approved by that agency for phosphorus treatment.

Table 4.1 – Treatment Trains for Phosphorus Removal	
First Basic Treatment Facility	**Second Treatment Facility**
Biofiltration Swale	Basic Sand Filter or Sand Filter Vault
Filter Strip	Linear Sand Filter (no presettling needed)
Linear Sand Filter	Filter Strip
Basic Wetpond	Basic Sand Filter or Sand Filter Vault
Wetvault	Basic Sand Filter or Sand Filter Vault
Stormwater Treatment Wetland	Basic Sand Filter or Sand Filter Vault
Basic Combined Detention and Wetpool	Basic Sand Filter or Sand Filter Vault

Projects for which phosphorus control is required may be subject to requirements for enhanced treatment as well (see Step 5e). In that event, a facility or treatment train must be selected that that satisfies both requirements.

Step 5e: Determine if enhanced treatment is required.

Except as stated in SCC 30.63A.530(6)-(7), enhanced treatment is required for the following project sites that discharge to fish-bearing streams, lakes, or to waters or conveyance systems tributary to fish-bearing streams or lakes:

- Industrial project sites;
- Commercial project sites;
- Multi-family project sites; and
- High ADT roads as follows:
    - Within Urban Growth Management Areas:
        - Fully controlled and partially controlled limited access roads with Average Daily Traffic (ADT) counts of 15,000 or more
        - All other roads with an ADT of 7,500 or greater

- Outside of Urban Growth Management Areas:
  - Roads with an ADT of 15,000 or greater unless discharging to a 4th Strahler order stream or larger;
  - Roads with an ADT of 30,000 or greater if discharging to a 4th Strahler order stream or larger (as determined using 1:24,000 scale maps to delineate stream order).

If enhanced treatment is required, select one of the treatment systems below.

- Infiltration through soils meeting the minimum site suitability criteria for infiltration treatment.

- Infiltration through soils that do not meet the minimum site suitability criteria for infiltration treatment, preceded by a basic treatment facility, provided that the infiltration site is not within ¼ mile of a fish-bearing stream, a tributary to that stream, or a lake.

- Large sand filter
- Amended sand filter
- Stormwater treatment wetland
- Compost-amended filter strip
- Bioretention
- WSDOT media filter drain - see the 2008 Washington State Department of Transportation Highway Runoff Manual for design and construction requirements.
- Treatment train for dissolved metals removal – See Table 4.2

Table 4.2 – Treatment Trains for Dissolved Metals Removal	
First Basic Treatment Facility	**Second Treatment Facility**
Biofiltration Swale	Basic Sand Filter or Sand Filter Vault or Media Filter(1)
Filter Strip	Linear Sand Filter with no pre-settling cell needed
Linear Sand Filter	Filter Strip
Basic Wetpond	Basic Sand Filter or Sand Filter Vault or Media Filter(1)
Wetvault	Basic Sand Filter or Sand Filter Vault or Media Filter(1)
Basic Combined Detention/Wetpool	Basic Sand Filter or Sand Filter Vault or Media Filter(1)
Basic Sand Filter or Sand Filter Vault with a presettling cell if the filter isn't preceded by a detention facility	Media Filter(1)

Footnote:

(1) The media must be of a type approved by Ecology. See Chapter 12 for more information.

If Enhanced Treatment does not apply to the site, proceed to Step 5f.

Step 5f: Select a Basic Treatment Facility.

The Basic Treatment Menu applies to project sites for which treatment is required but which do not trigger the requirements for oil control, phosphorus control, or enhanced treatment listed in the step above. For developments with a mix of land use types, the basic treatment requirement shall apply when the runoff from the areas subject to the basic treatment requirement compose 50% or more of the total runoff within a threshold discharge area.

If basic treatment is required, select one of the following treatment systems:

- Bioinfiltration swale
- Infiltration treatment
- Sand filter
- Biofiltration swale
- Filter strip
- Basic wetpond
- Wetvault – allowed only for commercial, industrial, or road projects if there are space limitations. Combined detention/wetvaults are allowed; see Volume V, Chapter 10.3.

- Stormwater treatment wetland
- Combined detention and wetpool facilities
- Bioretention
- WSDOT media filter drain – see the 2008 Washington State Department of Transportation Highway Runoff Manual for design and construction requirements.
- StormFilter with ZPGTM media – see Volume V, Chapter 12.

Step 5g: Final treatment system selection

Table 4.3 presents appropriate treatment options for each treatment requirement as applied to a variety of project and site types. Refer to Table 4.3 to check that the proper treatment system or treatment train is selected for the project.

Refer to Volume V and Snohomish County EDDS for design and construction criteria for the selected treatment systems, and to Volume III for infiltration treatment soils criteria.

The treatment facility selection process is completed.

Step 6: Review Selection of BMPs and Facilities

The list of treatment and flow control facilities and the list of source control BMPs should be reviewed. The site designer may want to re-evaluate site layout to reduce the need for construction of facilities, or the size of the facilities by reducing the amount of impervious surfaces created and increasing the areas to be left undisturbed.

Step 7: Complete Development of Permanent Stormwater Control Plan

SCC 30.63A.430 sets forth requirements for development of a permanent stormwater control plan. The design and location of the BMPs and facilities on the site must be determined using the requirements in Volumes III, IV, and V.

Table 4.3 Stormwater Treatment Options for New Development and Redevelopment Projects

Pollutant Sources	Pollutants of Concern	Basic Treatment	Enhanced Treatment	Phosphorus Treatment
ROOFS:				
Com/Ind				
Metal	Zn	STW/INF	LSF/ASF/STW/INF	
Vents & Emissions[2]	O & G, TSS, Organics	OWS/CBI + BF/WP/STW	OWS/CBI + INF/ASF/STW/LSF	OWS/CBI + INF/LWP/LSF
PARKING LOT/DRIVEWAY:				
>High-use Site	High O & G, TSS, Cu, Zn, PAH	OWS/CBI/LinSF + BF/WP/STW	OWS/CBI + BF/WP/WV + SF	OWS/CBI + LSF/LWP, or OWS/CBI + BF/WP/WV+ SF
<High-use	O & G, TSS	BF/WP/STW	BF/WP/STW/WV + SF	LSF/LWP, or BF/WP/WV+SF
STREETS/ROADS:				
Road with high ADT	O & G, TSS, Cu, Zn, PAH	BF/WP/WV/STW	INF/LSF/ASF/STW, or BF/WV/WP + SF	INF/LSF/LWP, or BF/WV + SF
Roads with low ADT	Low O & G, TSS, Cu, Zn	BF/WP/STW/INF	Not Applicable	INF/LSF/LWP, or BF/WV + SF
High Use Site Intersections	High O & G, TSS, Cu, Zn, PAH	OWS + BF/WP/WV/LinSF	OWS + BF/WV+SF, or OWS + LinSF+BF	OWS + ASF, or OWS + LinSF + Filter Strip
OTHER SOURCES:				
Com/Ind Development	O & G, TSS, Cu, Zn	WP/WV/SF/STW	LSF/ASF/STW, or BF/WP/WV + SF	LSF/ASF/LWP, or BF/WP/STW + SF
Residential Development	TSS, Pest/ Herbicides Nutrients	INF/BF/WP/SF/STW	Not Applicable	INF/LSF/LWP, or BF/WP/STW + SF
Large PGPS	TSS, Nutrients, Pest/Herbicides	WP/STW/SF	Not Applicable	LSF/LWP, or WP/STW + SF
Uncovered Fueling Stations:	High conc. O & G	OWS + BF/WP	OWS + LSF/ASF, or OWS+LinSF+Filter strip	OWS + LSF/ASF, or OWS+LinSF+ Filter strip
Industrial Yards	High O & G, TSS, Metals, PAH	OWS/CBI + BF/WP, or PSB/WV + OWS/CBI + BF/WP	OWS/CBI + LSF/ASF/STW, or OWS/CBI + BF/WP/WV + SF	OWS/CBI + LSF/ASF/LWP, or OWS/CBI + BF/WP/STW + SF
	Metals, TSS, PAH	BF/WP/STW , or PSB +BF/WP/STW	LSF/ASF/STW, or BF/WP/WV + SF	LSF/ASF/LWP, or BF/WP/STW + SF

ASF = Amended Sand Filter | **BF** = Biofilter (includes swales and strips) | **CBI** = Catch Basin Insert (if applicable -see Chapter 12, Volume V) | **Cu** = Copper | **Com/Ind** = Commercial or industrial | **INF** = Infiltration | **LSF** = Large Sand Filter | **LinSF** = Linear Sand Filter | **LWP** = Large Wet Pond | **O&G** = Oil and Grease | **OWS** = Oil & Water Separator | **PAH** = Polycyclic Aromatic Hydrocarbons | **PSB** = Presettling Basin | **PGPS** = Pollution-generating pervious surface | **SF** = Sand Filter | **STW** = Stormwater Treatment Wetland | **TSS** = Total Suspended Solids | **WP** = Wet Pond | **WV** = Wetvault | **Zn** = Zinc / = or
The slashes between the abbreviations for treatment types are intended to indicate equivalent treatment options.

Table 4.4 Ability of Treatment Facilities to Remove Key Pollutants

	TSS	Dissolved Metals	Soap	Total Phosphorus	Pesticides/ Fungicides	Hydrocarbons
Wet Pond	⌖	+		+	+	+
Wet Vault	⌖			+	+	+
Biofiltration	⌖	+		+	+	+
Sand Filter	⌖	+		+	+	⌖
Constructed Wetland	⌖	⌖	⌖		⌖	⌖
Compost Filters	⌖	+			⌖	⌖
Infiltration(1)	⌖			⌖	+	⌖
Oil/Water Separator	+			+	+	⌖

Notes:

⌖ Major Process

\+ Minor Process

(1) Assumes Loamy sand, Sandy loam, or Loam soils

Table 4.5 Screening Treatment Facilities Based On Soil Type

Soil Type	Infiltration	Wet Pond*	Biofiltration* (Swale or Filter Strip)
Coarse Sand or Cobbles	✕	✕	✕
Sand	✔	✕	✕
Loamy Sand	✔	✕	✔
Sandy Loam	✔	✕	✔
Loam	✕	✕	✔
Silt Loam	✕	✕	✔
Sandy Clay Loam	✕	✔	✔
Silty Clay Loam	✕	✔	✔
Sandy Clay	✕	✔	✔
Silty Clay	✕	✔	✕
Clay	✕	✔	✕

Notes:

✔ Indicates that use of the technology is generally appropriate for this soil type.

✕ Indicates that use of the technology is generally not appropriate for this soil type

* Coarser soils may be used for these facilities if a liner is installed to prevent infiltration, or if the soils are amended to reduce the infiltration rate.

Note: Sand filtration is not listed because its feasibility is not dependent on soil type.

Volume I References and Additional Reading

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Appendix I-A Low Impact Development BMPs

Introduction

This appendix lists the Low Impact Development (LID) stormwater management BMPs described in this manual that qualify as LID BMPs for the purposes set forth in Snohomish County codes, such as Chapter 30.63C SCC - Low Impact Development. Some of these BMPs, such as the on-site stormwater infiltration and dispersion BMPs set forth in Volumes III and V, must be implemented in certain projects according to requirements in Chapter 30.63A SCC (Drainage). Others, such as bioretention facilities, are LID BMPs by virtue of their scale or hydrologic function, and, if implemented, shall be factored into hydrologic modeling for a project, but these BMPs are not required by any Snohomish County code, including codes that require implementation of LID BMPs in certain geographic areas or certain types of development such as rural cluster subdivisions.

This appendix also lists LID BMPs that are not drainage facilities, but that qualify as LID BMPs for the purposes of Chapter 30.63C SCC, and that need to be considered in hydrologic modeling required by Chapter 30.63A SCC. An example is permeable pavement, a collective term for porous asphalt, porous concrete, permeable pavers and grid/lattice pavement systems. Permeable pavement is gaining wider usage for its ability to provide a pavement surface that infiltrates runoff. However, site-specific engineering design is required to ensure proper functioning of the pavement, including infiltration and structural stability. No single design is appropriate for every use or location, but general design guidelines have been compiled for pedestrian facility projects and are provided in EDDS Section 4-10, Permeable Pavement.

LID BMPs for which implementation is required by Chapters 30.63A and 30.63C SCC

Drainage facility LID BMPs

Snohomish County Drainage Manual Volume III
- Non-Pollution-Generating Surface (NPGIS) infiltration systems
- NPGIS dispersion systems
- NPGIS perforated stub-out connections

Snohomish County Drainage Manual Volume V
- Pollution-generating impervious surface (PGIS) concentrated flow dispersion
- PGIS sheet flow dispersion
- Soil quality and depth

LID BMPs for which implementation is <u>not required</u> by County code

Drainage facility LID BMPs

<u>Snohomish County Drainage Manual Volume III</u>
Bioretention facilities (basins, swales, and slopes)
<u>Snohomish County Drainage Manual Volume V</u>
Full dispersion
<u>WSDOT Highway Runoff Manual, allowed pursuant to SCC 30.63A.140</u>
Natural dispersion
Engineered dispersion

Other LID BMPs for which implementation is <u>not required</u> by County code

Permeable pavement
Vegetated roofs
Minimal excavation or pin-pile foundations

Appendix I-B
Water Quality Treatment Design Storm, Volume, and Flow Rate

Water Quality Design Storm: A 24-hour storm with a 6-month return frequency (6-month, 24-hour storm). The 6-month, 24-hour storm can be estimated as 72% of the 2-year, 24-hour rainfall amount for areas in western Washington.

Water Quality Design Storm Volume: The volume of runoff predicted from a 6-month, 24-hour storm. Alternatively, the 91st percentile, 24-hour runoff volume indicated by an approved continuous runoff model.

Facilities such as wetpools are sized based upon either: 1) the volume of runoff produced by the water quality design storm, or 2) the 91st percentile, 24-hour runoff volume indicated by an approved continuous runoff model. They are the same size whether they precede, follow, or are incorporated (i.e., combined detention and wetpool facilities) into detention facilities for flow control. The water quality design storm volume can be computed using the SCS (NRCS) curve number equations in Volume III, Chapter 2.

Unless amended to reflect local precipitation statistics, the 6-month, 24-hour precipitation amount may be assumed to be 72 percent of the 2-year, 24-hour amount. Precipitation estimates of the 6-month and 2-year, 24-hour storms for certain towns and cities are listed in this appendix. For other areas, interpolating between isopluvials for the 2-year, 24-hour precipitation and multiplying by 72% yields the appropriate storm size. Isopluvials for 2-year, 24-hour amounts for Western Washington are reprinted in Volume III.

Background for the Water Quality Design Storm and Volume:

The 6-month, 24-hour storm was the water quality design storm in the 1992 Stormwater Management Manual for the Puget Sound Basin. It was originally chosen when developing the Puget Sound manual based upon a judgment of when the incremental costs of additional treatment capacity exceed the incremental benefits. In particular, the cost of providing the increased detention volume for a wet pond was not seen as cost-effective when compared with the incremental amount of annual stormwater volume that would be effectively treated. Rainfall data from Sea-Tac was used in the original analysis.

Estimation of the 6-month, 24-hour rainfall amount for rain gauge sites: There are at least two ways to estimate the rainfall amount of a 6-month, 24-hour storm. One way is to analyze the 24-hour rainfall records for each rainfall station. The more extensive the record is, the more confidence there is in the estimate. The rainfall amount which has a probability of being equaled or exceeded twice a year is the 6-month, 24-hour storm. The 6-month, 24-hour rainfall amounts shown for 58 stations in Table B.1 have been estimated by analyzing the daily rain gauge data obtained from CD-ROM Hydrodata, USGS Daily and Peak Values, published by Hydrosphere Data Products, Inc. [11]

The way in which the 6-month, 24-hour estimates in Table B.2 are calculated is as follows. A data set containing the annual maxima series for 24-hour durations for rainfall stations throughout the state was used to determine the 2-year, 24-hour return frequency in the first column of Table B.2. The data set was collected by Dr. Schaefer of the Washington State Department of Ecology and is more fully described in "Regional Analyses of Precipitation Annual Maxima in Washington State"[12]. An algorithm was applied to convert the series to a partial duration series. Dr. Schaefer describes the conversion as follows: "A return period of 1.16 years (annual exceedance probability of 0.862) in the annual maxima data series is equivalent to a 6-month return period in the partial duration data series. The 6-month values were computed using at-site 24-hour station mean values, regional coefficients of variation (Cv) and L-skewness (tau3), and a frequency factor (K) of –0.94 which corresponds to a return period of 1.16 years. This K value of –0.94 yields 6-month estimates that are correct within 3% +/- for various Kappa distribution parameter sets for climates from arid to rainforest in Washington State." (The reader is referred to Volume I References #13 and #14.) Note that the 2-year storm values in Table B.2 differ slightly from those in Table B.1 because they are a different data set and have undergone additional statistical analysis. Where a single site is listed in both tables, the value listed in Table B.2 should be used.

Estimation of 6-month, 24-hour amounts for any project site:

A disadvantage to using the 6-month, 24-hour storm as the design storm is that all isopluvials identifying 6-month, 24-hour storms statewide do not exist. A map would need to be produced, or a method developed to estimate the volume for projects at sites not listed in a reference table of 6-month, 24-hour storms. One method to do the latter is described below.

The first step is to look for a consistent relationship between the 6-month, 24-hour rainfall amount and a rainfall amount for which we have isopluvials. Based upon an analysis of the rainfall record of 58 stations across the state, the 6-month, and 2-year, 24-hour rainfall amounts were calculated and compared. Those results are shown in Table B.1. The arithmetic average of the ratio of the 6-month to the 2-year totals for 35 stations in western Washington (expressed as a percentage) was 71%. The median was 72%. With the exception of a few stations, the percentages vary within a range of 67% to 76%.

Updated statewide isopluvial maps for the 2-year, 24-hour rainfall amounts are expected to be available soon. By interpolation, the 2-year rainfall amount for a project site can be easily identified. Multiplying the 2-year amount by 72% yields an estimate of the 6-month, 24-hour rainfall amount.

Justification for use of the 6-month, 24-hour storm:

In the manual update, it is consistently proposed to retain the 6-month, 24-hour storm (hereafter referred to as the 6/24 storm) as the "Water Quality Design Storm." The 1992 manual noted that 24-hour storms up through the 6/24 storm produced 91% of the historic runoff volume (Sea-Tac Airport rain data). That is probably an overestimate because many smaller storms do not produce measurable runoff and the statement ignores the fact of variability in soil absorption capacity preceding each event. However, it is the presumption made in 1992, and it is not fatally incorrect.

The original basis for the 6-month, 24-hour rainfall amount was a cost- effectiveness analysis referred to in Appendix AI-2.1 of the '92 manual. The assumption in these comparisons is that

storm sizes crudely track relative runoff quantities. The cost analysis simply compared the incremental cost increase in wet ponds sized to treat the 91st percentile storm versus the 95th percentile storm. For a 4% increase in annual treated volume, the pond had to be increased by 34% in volume. That was seen as being not cost-effective and therefore not cost reasonable. (The costs to treat the runoff from the 91st percentile storm were further supported by an analysis for three example developments (Herrera, 1993)).

The percentage of the 24-hour rainfall volumes that the 6-month, 24-hour storm and smaller 24-hour rainfall amounts represent changes across the state. For the 34 western Washington stations computed, the 6-month storm and smaller storms represent from 88.4% to 93.4% of the total rainfall volume. See Table B.1, column entitled, "6 month, % Rainfall Volume." Therefore, the cost-effectiveness analysis is not exactly the same for other areas. However, because the 91% value for Sea-Tac is a mid-range figure for a data set with small variation, the cost analysis is a reasonable basis for setting the 6-month, 24-hour storm as the water quality design storm.

Citing a particular percentage of the 2-year, 24-hour rainfall amount (or a 6-month, 24-hour event) means that different areas of the state will be effectively sizing treatment facilities for the runoff from storms of different sizes. However, those size differences are based upon actual differences in rainfall amounts among the sites.

Water Quality Design Flow Rate:

Preceding detention facilities or when detention facilities are not required: The flow rate at or below which 91% of the runoff volume, as estimated by an approved continuous runoff model, will be treated. Design criteria for treatment facilities are assigned to achieve the applicable performance goal at the water quality design flow rate (e.g., 80% TSS removal).

Downstream of detention facilities: The full 2-year release rate from the detention facility.

Background for the Water Quality Design Flow Rate:

Basis for Water Quality Design Flow Rate in 1992 Manual:

The cost effectiveness analysis performed for the 1992 manual seems to assumed that BMPs sized by flow rate (bioswales, filter strips, oil/water separators), using the 10-minute peak flow predicted by SBUH for a 6/24 storm, and a Type 1A storm distribution would result in treating roughly 91 percent of the annual runoff volume. That appears to be an incorrect assumption. The error is caused by the size of the 10-minute peak increment of the 6/24 storm when compared to the actual rainfall intensities experienced in western Washington. The Olympia, Lacey, Tumwater, Thurston Co. stormwater managers provided some actual 2-hour rainfall intensity statistics for Olympia, and compared these to the intensity predicted by a 6/24, type 1A storm for Olympia. The statistics seem to confirm the conservativeness of the original assumption.

Basis for a new Water Quality Design Flow Rate:

The use of continuous runoff modeling techniques provides another perspective on flow rates. Continuous runoff modeling takes a long, uninterrupted record of observed rainfall data and transforms it into a record (a.k.a., time series) of runoff data. This is done by use of a set of mathematical algorithms that represent the rainfall-runoff processes. The model's algorithms are adjusted to simulate the rainfall/runoff relationships of a particular watershed. HSPF,

Hydrological Simulation Program – Fortran, is one type of continuous runoff model. The Department of Ecology has funded the development of an HSPF-based continuous runoff model for Western Washington using the best available precipitation and mathematical algorithms. It is referred to as the Western Washington Hydrology Model (WWHM). King County has already employed an HSPF-based model (King County Runoff Time Series, KCRTS) to estimate runoff flow rates and volumes in their jurisdiction.

Runoff flow rates for a number of different development scenarios have been estimated and compared using KCRTS and the Santa Barbara Urban Hydrograph Method (SBUH). KCRTS was used for this comparison because it provides flow rates in 15-minute time increments. At the time of this analysis the WWHM only provided 1-hour increments. A 15-minute increment data set is more comparable to the 10-minute time step of the SBUH analysis. It is expected that a comparison between the WWHM and SBUH would provide similar results as the KCRTS vs. SBUH comparison.

A spreadsheet can be used to statistically analyze the long time series of runoff predicted by KCRTS. That analysis shows that only 2.5 to 3% of the annual runoff volume is discharged at a rate that equals or exceeds the peak 10 minute runoff predicted by SBUH for the water quality design storm. This is a second indicator that the 1992 manual water quality design flow rate is too conservative if the intent is to provide effective treatment for 91% of the runoff volume.

Using the same spreadsheet, a flow rate can be identified above which only 9% of the annual runoff volume is discharged. However, that flow rate is still too conservative if the intent is to provide effective treatment for 91% of the annual runoff volume. An off-line facility that is designed to receive and effectively treat a flow rate at or below which 91% of the annual volume is discharged, will actually treat 97 to 98% of the annual runoff volume. This occurs because a flow splitter continues to send a portion (in this instance, the flow rate above which only 9% of the runoff volume is discharged) of the higher flow rates to the treatment facility. To treat 91% of the annual runoff volume, a flow splitter should start to bypass incremental portions of flow rates above a rate at which 72 to 80% of the runoff volume is discharged. The above percentage changes with project characteristics, most notably the percent imperviousness of a project.

This flow rate, which a flow splitter must route to the treatment facility in an off-line mode, becomes the water quality design flow rate. This rate is sometimes referred to as the 91% flow rate in the manual. At the time of publication of the 2001manual, the WWHM did not identify this water quality design flow rate directly for the user. The user would have to take the output of the WWHM and perform a statistical analysis of the data set to determine the flow rate associated with treating 91% of the runoff volume. However, the WWHM only provides flow rates in 1-hour time increments. Further, it is more appropriate to use 15-minute time increments for facilities that perform their treatment function with short hydraulic residence times. Therefore, that flow rate would have to be increased by a factor to convert the hourly flow rate to an equivalent 15-minute flow rate.

WWHM2 now provides an estimate of the water quality design flow rate in 1-hour and 15-minute time steps, and for off-line and on-line facilities.

Water Quality Design Flow Rate Downstream of Detention Facilities:

The 91% flow rate downstream of detention will be significantly smaller than upstream of detention. The detention facilities, which are fitted with flow-restricting orifices, significantly change the distribution of flow rates. The flow duration standard requires that the total amount of time that flows are discharged above ½ of the 2-year flow not increase. There is a much greater volume of surface runoff post-development than pre-development. Therefore, an extra volume of water must be discharged at rates below ½ the 2-year rate for extended periods of time.

The result of this redistribution is that downstream treatment facilities will operate for extended periods of time at flow rates at or near their design flow rate. For downstream facilities sized for the 91% flow rate this will achieve less annual treatment removal efficiency than that achieved by facilities located upstream. Upstream treatment facilities see more variable flow rates, and presumably, operate more efficiently at lower flow rates than the design flow rate. In addition, downstream detention facilities would have a hard time meeting the annual TSS removal performance goal of 80% removal. They also would need intensive maintenance as they are treating the same volume of water through substantially less treatment area and volume.

In order to compensate for this, the water quality design flow rate, downstream of detention facilities is the 2-year return frequency flow from a detention facility that is designed to meet the flow duration standard. The 2-year frequency flow rate represents a flow rate that will effectively treat a greater percentage of the annual runoff volume than 91%. In addition, flow rate-based treatment facilities downstream of detention should only be designed to be on-line facilities. These downstream water quality design flow rates are 3.5 times smaller than upstream, off-line flow rates, and 6.5 times smaller than upstream, on-line flow rates.

This requirement applies to treatment facilities that are sized based upon a short hydraulic residence time or velocity. This would include biofiltration swales, oil/water separators, and sand/media filters that are not preceded by a significant storage reservoir (i.e., above the filtration unit). Where a sand/media filter is preceded by a significant equalization/storage reservoir, it may be sized using a continuous runoff model and a volume-based approach to achieve the 91% or 95% volume targets (whichever is applicable).

Impact on Design Criteria:

The 1992 design criteria for some public domain treatment facilities had been intended to apply to the water quality design flow rate in the 1992 manual. The new water quality design flow rate is a fraction of that old rate. If the 1992 design criteria were retained and applied at the new water quality design flow rate, new treatment facilities would be that same fraction of the size of existing treatment facilities. This would not be a prudent action since it is not known whether existing treatment facilities can meet the proposed performance goals. Until more reliable monitoring information to judge the performance of existing treatment facilities exist, the prudent action is to adjust their design criteria such that they continue to be built to approximately the same size as they should have been built using the 1992 design criteria and design flow rates.

Table B.1 24-Hour Rainfall Amounts and Comparisons for Selected USGS Stations								
	Station Name	**6 Month Storm Inches**	**6 Month % Rainfall Volume**	**2 Year Storm Inches**	**6 Month/ 2 year %**	**90% Rainfall Inches**	**95% Rainfall Inches**	**Mean Annual Precip. Inches**
	Arlington	1.28	93.42%	1.74	73.6%	1.11	1.40	46.46
	Darrington	2.90	91.19%	4.01	72.3%	2.73	3.42	82.90
	Everett	1.10	93.14%	1.46	75.3%	1.00	1.22	36.80
	Monroe	1.38	92.90%	1.86	74.2%	1.26	1.53	48.16

Table B.2 24-Hour Rainfall Amounts and Statistics					
Station Name	**Return 2-yr.**	**Freq 6-month**	**Knee-of-curve 24 hr. (in)**	**Mean Annual Storm (in)**	**Mean Annual Precip (in)**
Arlington	1.79	1.35	1.40		46.5
Darrington RS	3.32	2.53	3.42	0.84	79.8
Duvall 3NE	1.99	1.50			50.0
Everett Jr. Col.	1.48	1.11	1.22	0.41	34.4
Mill Creek	2.04	1.53			35.0
Monroe	1.91	1.44	1.52		48.2

Appendix I-C
Basic Treatment Receiving Waters

1. All Salt Waterbodies

2. Rivers	**Basic Treatment Applies Below This Location**
Sauk	Clear Creek
Skagit	Cascade River
Skykomish	Beckler River
Snohomish	Snoqualmie River
Snoqualmie	Middle and North Fork Confluence
Stillaguamish	North and South Fork Confluence
North Fork Stillaguamish	Boulder River
South Fork Stillaguamish	Canyon Creek
Suiattle	Darrington

3. Lakes

[none in Snohomish County]

Note: The initial criteria for this list are rivers whose mean annual flow exceeds 1,000 cfs, and lakes whose surface area exceeds 300 acres. Additional waters do not have to meet these criteria, but should have sufficient background dilution capacity to accommodate dissolved metals additions from build-out conditions in the watershed under the latest Comprehensive Land Use Plan and zoning regulations.

Appendix I-D
Wetlands and Stormwater Management

SCC 30.63A.570 requires use of the following criteria for assessing the suitability of using wetlands for stormwater management, analyzing wetland hydroperiods, and designing modifications to wetlands used for stormwater management. Additional information about wetlands is available in Appendix 1-D of the *2005 Stormwater Management Manual for Western Washington*.

Wetland Assessment Criteria

These assessment criteria shall be used in order to comply with SCC 30.63A.570.

The following information is necessary to perform the required assessment:

- Boundary and area of the contributing watershed of the wetland or other landscape unit
- A complete definition of goals for the wetland and landscape unit subject to planning and management
- Existing management and monitoring plans
- Existing and projected land use in the landscape unit in the categories commercial, industrial, multi-family residential, single-family residential, duplex, agricultural, various categories of undeveloped, and areas subject to active logging or construction (expressed as percentages of the total watershed area)
- Drainage network throughout the landscape unit
- Soil conditions, including soil types, infiltration rates, and positions of seasonal water table (seasonally) and restrictive layers
- Groundwater recharge and discharge points
- Wetland category I - IV in the Dept. of Ecology's *Washington State Wetland Rating System for Western Washington*, designated as rare or irreplaceable. Refer to the Washington Natural Heritage Program database. If the needed information is not available, a biological assessment will be necessary.
- Watershed hydrologic assessment
- Watershed water quality assessment
- Wetland type and zones present, with special note of estuarine, priority peat system, forested, sensitive scrub-shrub zone, sensitive emergent zone and other sensitive or critical areas designated by Washington state or Snohomish County (with dominant plant species)
- Rare, threatened, or endangered species inhabiting the wetland
- History of wetland changes

- Relationship of wetland to other water bodies in the landscape unit and the drainage network
- Flow pattern through the wetland
- Fish and wildlife inhabiting the wetland
- Relationship of wetland to other wildlife habitats in the landscape unit and the corridors between them

Wetland category and functional scores referred to in this section are determined as per the *Washington State Wetland Rating System of Western Washington,* available at http://www.ecy.wa.gov/biblio/sea.htmles.

In general, the following circumstances are indicative of Category I or II wetlands:

- In its present state it is primarily an estuarine or forested wetland or a priority peat system.
- It is a rare or irreplaceable wetland type, as identified by the Washington Natural Heritage Program, the Puget Sound Water Quality Preservation Program, or Snohomish County.
- It provides critical species habitat that could be impaired by the proposed action. Critical species include those listed as threatened, endangered, or sensitive, or those designated as species of local importance. Determining whether or not the conserved species will be affected by the proposed project requires a careful analysis of its requirements in relation to the anticipated habitat changes.
- It provides a high level of many functions.

Category III wetlands may provide a moderate level of habitat functions but primarily serve water quality and quantity functions. In general, Category IV wetlands have monotypic vegetation of similar age and class, lack special habitat features, and are isolated from other aquatic systems.

The following criteria must be used to determine if a natural wetland may or may not be structurally or hydrologically engineered for control of stormwater quantity, quality, or both.

1. A wetland shall not be structurally or hydrologically engineered for runoff quantity or quality control if the wetland is classified as Category I or II, or if it is classified as Category III or IV and has any of the following characteristics:

    - significant priority peat system or forested zones that will experience substantially altered hydroperiod as a result of the proposed project;
    - regionally unusual biological community types;
    - animal habitat features of relatively high value in the region (e. g., a protected, undisturbed area connected through undisturbed corridors to other valuable habitats, an important breeding site for protected species) as exhibited by a habitat function

score of 20 or greater per the "Washington State Wetland Rating System of Western Washington;

- the presence of protected commercial or sport fish; or
- configuration and topography that will require significant modification that may threaten fish stranding.

2. A wetland can be considered for structural or hydrological modification for runoff quantity or quality control if both criteria (a) and (b) below are met:

   a. The wetland is classified as Category III with a habitat function score less than 20 or is classified as Category IV, and all of the following conditions are met:

      - any functions lost through hydrologic or structural modification in a Category III or IV wetland would have to be mitigated pursuant to Chapter 30.62 SCC, 30.62A SCC, or other applicable code provisions;
      - the wetland lies in the natural routing of the runoff; and
      - the wetland allows runoff discharge at the natural location.

   b. One or more of the following conditions exist:

      - the wetland has been previously disturbed by human activity, as evidenced by agriculture, fill, ditching, and/or introduced or invasive weedy plant species;
      - the wetland has been deprived of a significant amount of its water supply by draining or previous urbanization, and stormwater runoff is sufficient to augment the water supply (for example, a wetland that has experienced an increased summer dry period, especially if the drought has been extended by more than two weeks);
      - construction for structural or hydrologic modification in order to provide runoff quantity or quality control will disturb relatively little of the wetland;
      - the wetland can provide the required storage capacity for quantity or quality control through an outlet orifice modification to increase storage of water, rather than through raising the existing overflow (orifice modification is preferred);
      - under existing conditions the wetland experiences a relatively high degree of water level fluctuation and a range of velocities (for example, a wetland associated with substantially flowing water, rather than one in the headwaters or entirely isolated from flowing water; or
      - the wetland is threatened by potential impacts exclusive of stormwater management, and could receive greater protection if acquired for a stormwater management project rather than left in existing ownership.

Hydroperiod Analysis and Design Criteria

These hydroperiod analysis and design criteria shall be used to comply with SCC 30.63A.570.

Hydroperiod analysis and stormwater mitigation design shall be based on the following information:

- Existing and potential stormwater pollution sources
- Existing and projected land use contributing to the wetland
- Existing and projected wetland hydroperiod characteristics
- Wetland bathymetry
- Inlet and outlet locations and hydraulics
- Landscape unit soils, geologic and hydrogeologic conditions
- Wetland type and zones present
- Presence of breeding populations of native amphibian species
- Presence of forest and wetland obligate bird species
- Presence of fish species

Protection of wetland plant and animal communities depends on controlling the wetland's hydroperiod, meaning the pattern of fluctuation of water depth and the frequency and duration of exceeding certain levels, including the length and onset of drying in the summer. A hydrologic assessment is required to measure or estimate elements of the hydroperiod under existing predevelopment and anticipated postdevelopment conditions. This assessment shall be performed by a licensed Civil Engineer with the aid of a qualified hydrologist or hydrogeologist and a biologist. Postdevelopment estimates of watershed hydrology and wetland hydroperiod must include the cumulative effect of all anticipated watershed and wetland modifications. This analysis hypothesizes a fluctuating water stage over time before development that could fluctuate more, both higher and lower after development; these greater fluctuations are termed stage excursions.

Hydroperiod limits applicable to all zones within all wetlands over the entire year

The following hydroperiod limits apply to all zones within all wetlands over the entire year:

- The limits on the frequency and duration of excursions, as well as on overall water level fluctuation, after development shall not exceed 6 inches or 15 cm. in height over a 48 hour period based on a continuous runoff model analysis of the drainage flowing to the wetland. Monitoring of the wetland water surface elevation shall occur at least 8 times during the wet season prior to development to establish the existing condition. The hydrologic model used to predict future conditions must be calibrated to the hydrologic data collected at the site and tested by running the model for the period of monitoring. The model will be considered an adequate representation of the system only if the results from the model deviate less than +/-15 percent of the actual values for the stage of the wetland duration of at least 8 times during the wet season sampling days.
- The total dry period (when pools dry down to the soil surface everywhere in the wetland) does not increase or decrease by more than two weeks in any year.
- Alterations to watershed and wetland hydrology that may cause perennial wetlands to become vernal are avoided.

If the analysis shows greater than these levels of stage excursion and impact to the wetland, one or more of the following management strategies shall be used to stay within the prescribed limits:

- reduction of the level of development;
- increasing runoff infiltration;
- increasing runoff storage capacity without dredging or filling.

Additional hydroperiod limits applicable to all zones of priority peat wetlands over the entire year

In addition to the requirements set forth above for all wetlands, the following hydroperiod limit applies to all zones of priority peat wetlands over the entire year:

- the duration of stage excursions above the predevelopment stage does not exceed 24 hours in any year.

If the analysis shows greater than these levels of stage excursion and impact to the wetland, one or more of the following management strategies shall be used to stay within the prescribed limits:

- reduction of the level of development;
- increasing runoff infiltration;
- increasing runoff storage capacity without dredging or filling.

Additional hydroperiod limits and design criteria applicable to wetlands inhabited by breeding native amphibians from February 1st through May 31st

In addition to the requirements set forth above for all wetlands, the following hydroperiod limits and design criteria apply to amphibian breeding zones in wetlands inhabited by breeding native amphibians from February 1st through May 31st:

- the magnitude of stage excursions above or below the predevelopment stage should not exceed 8 cm for more than 24 hours in any 30-day period;
- avoid decreasing the sizes of the open water and aquatic bed zones;
- avoid increasing the channelization of flow. Do not form channels where none exist, and take care that inflows to the wetland do not become more concentrated and do not enter at higher velocities than accustomed. If necessary, concentrated flows can be uniformly distributed with a flow-spreading device such as a shallow weir, stilling basin, or perforated pipe. Velocity dissipation can be accomplished with a stilling basin or rip-rap pad;
- limit the post-development flow velocity to < 5 cm/s (0.16 ft/second) in any location that had a velocity in the range 0-5 cm/s in the pre-development condition; and
- avoid increasing the gradient of wetland side slopes.

If the analysis shows greater than these levels of stage excursion and impact to the wetland, one or more of the following management strategies shall be used to stay within the prescribed limits:

- reduction of the level of development;
- increasing runoff infiltration;
- increasing runoff storage capacity without dredging or filling.

Additional hydroperiod limits applicable to wetlands inhabited by fish

In addition to the requirements set forth above for all wetlands, the following design criteria apply to wetlands inhabited by fish:

- Protect fish habitats by avoiding water velocities above tolerated levels (selected with the aid of a qualified fishery biologist to protect fish in each life stage when they are present), siltation of spawning beds, etc. Habitat requirements vary substantially among fish species. If the wetland is associated with a larger water body, contact the Department of Fisheries and Wildlife to determine the species of concern and the acceptable ranges of habitat variables.
- If stranding of protected commercial or sport fish could result from a structural or hydrologic modification for runoff quantity or quality control, develop a strategy to avoid stranding that minimizes disturbance in the wetland (e. g., by making provisions for fish return to the stream as the wetland drains, or avoiding use of the facility for quantity or quality control during fish presence).

If the analysis shows greater than these levels of stage excursion and impact to the wetland, one or more of the following management strategies shall be used to stay within the prescribed limits:

- reduction of the level of development;
- increasing runoff infiltration;
- increasing runoff storage capacity without dredging or filling.

Additional Guidance Information

The following information may be useful but is not explicitly required by Snohomish County code.

Guidelines for the Protection of Specific Biological Communities

1. For wetlands inhabited by forest bird species:
   - Retain areas of coniferous forest in and around the wetland as habitat for forest species.
   - Retain shrub or woody debris as nesting sites for ground-nesting birds and downed logs and stumps for winter wren habitat.
   - Retain snags as habitat for cavity-nesting species, such as woodpeckers.
   - Retain shrubs in and around the wetland for protective cover. If cover is insufficient to protect against domestic pet predation, consider planting native bushes such as rose species in the buffer.
2. For wetlands inhabited by **wetland obligate** bird species:
   - Retain **forested zones**, sedge and rush meadows, and deep open water zones, both without vegetation and with submerged and floating plants.
   - Retain shrubs in and around the wetland for protective cover. If cover is insufficient to protect against domestic pet predation, consider planting native bushes such as rose species in the buffer.
   - Avoid introducing **invasive weedy plant species**, such as purple loosestrife and reed canary grass.
   - Retain the buffer zone. If it has lost width or forest cover, consider re-establishing forested buffer area at least 30 meters (100 ft) wide.
   - If human entry is desired, establish paths that permit people to observe the wetland with minimum disturbance to the birds.

Wetlands Guidance Appendix 2: Definitions

Baseline sampling	Sampling performed to define an existing state before any modification occurs that could change the state.
Bioengineering	Restoration or reinforcement of slopes and stream banks with living plant materials.
Buffer	The area that surrounds a wetland and that reduces adverse impacts to it from adjacent development.
Constructed wetland	A wetland intentionally created from a non-wetland site for the sole purpose of wastewater or stormwater treatment. These wetlands are not normally considered Waters of the United States or Waters of the State.
Degraded (disturbed) wetland (community)	A wetland (community) in which the vegetation, soils, and/or hydrology have been adversely altered, resulting in lost or reduced functions and values; generally, implies topographic isolation; hydrologic alterations such as hydroperiod alteration (increased or decreased quantity of water), diking, channelization, and/or outlet modification; soils alterations such as presence of fill, soil removal, and/or compaction; accumulation of toxicants in the biotic or abiotic components of the wetland; and/or low plant species richness with dominance by invasive weedy species
Enhancement	Actions performed to improve the condition of an existing degraded wetland, so that functions it provides are of a higher quality.
Estuarine wetland	Generally, an eelgrass bed; salt marsh; or rocky, sandflat, or mudflat intertidal area where fresh and salt water mix. (Specifically, a tidal wetland with salinity greater than 0.5 parts per thousand, usually semi-enclosed by land but with partly obstructed or sporadic access to the open ocean).
Forested communities (wetlands)	In general terms, communities (wetlands) characterized by woody vegetation that is greater than or equal to 6 meters in height; in these guidelines the term applies to such communities (wetlands) that represent a significant amount of tree cover consisting of species that offer wildlife habitat and other values and advance the performance of wetland functions overall.
Functions	The ecological (physical, chemical, and biological) processes or attributes of a wetland without regard for their importance to

	society (see also Values). Wetland functions include food chain support, provision of ecosystem diversity and fish and wildlife habitat, flood flow alteration, groundwater recharge and discharge, water quality improvement, and soil stabilization.
Hydrodynamics:	The science involving the energy and forces acting on water and its resulting motion.
Hydroperiod	The seasonal occurrence of flooding and/or soil saturation; encompasses the depth, frequency, duration, and seasonal pattern of inundation.
Invasive weedy plant species	Opportunistic species of inferior biological value that tend to out-compete more desirable forms and become dominant; applied to non-native species in these guidelines.
Landscape unit	An area of land that has a specified boundary and is the locus of interrelated physical, chemical, and biological processes.
Modification, Modified (wetland)	A wetland whose physical, hydrological, or water quality characteristics have been purposefully altered for a management purpose, such as by dredging, filling, forebay construction, and inlet or outlet control.
On-site	An action (here, for stormwater management purposes) taken within the property boundaries of the site to which the action applies.
Polishing	Advanced treatment of a waste stream that has already received one or more stages of treatment by other means.
Predeveloped condition, or Predevelopment condition	Predeveloped condition or predevelopment condition means a fully-forested condition (soils and vegetation) of second-growth forest to which the Western Washington Hydrologic Model (WWHM) is calibrated, unless reasonable, historic information is provided that indicates the site was prairie prior to Euro-American settlement. See SCC 30.91P.258)
Pre-treatment	An action taken to remove pollutants from runoff before it is discharged into another system for additional treatment.
Priority peat systems	Unique, irreplaceable fens that can exhibit water pH in a wide range from highly acidic to alkaline, including fens typified by Sphagnum species, Rhododendron groenlandicum (Labrador tea),

	Drosera rotundifolia (sundew), and Vaccinium oxycoccos (bog cranberry); marl fens; estuarine peat deposits; and other moss peat systems with relatively diverse, undisturbed flora and fauna. Bog is the common name for peat systems having the Sphagnum association described, but this term applies strictly only to systems that receive water income from precipitation exclusively.
Redevelopment	(See SCC 30.91R.070) The creation or addition, of new impervious surfaces on already substantially developed site that has 35 percent or more of existing impervious surface coverage where the creation or addition of impervious surfaces; the ground area expansion of a building footprint or addition or replacement of a structure; structural development including construction, installation or expansion of a building or other structure; replacement of impervious surface that is not part of a routine maintenance activity; and land disturbing activities that must meet the redevelopment thresholds. Overlay projects are routine maintenance and shall not be considered redevelopment. Construction which cuts and subsequently repairs existing impervious surface including trenching or utility installation or maintenance which is outside critical areas is considered routine maintenance.
Regional	An action (here, for stormwater management purposes) that involves more than one discrete property.
Restoration	Actions performed to reestablish wetland functional characteristics and processes that have been lost by alterations, activities, or catastrophic events in an area that no longer meets the definition of a wetland.
Source control best management practices(BMPs)	See SCC 30.91S.521. Structures, equipment, supplies or operations intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants.
Stage excursion	A post-development departure, either higher or lower, from the water depth existing under a given set of conditions in the pre-development state.
Structure	The components of an ecosystem, both the abiotic (physical and chemical) and biotic (living).

Threatened, or endangered species	(See SCC 30.91T.054) State and federally listed species. State species are listed under chapter 232-12 WAC. Federal species are listed under the Endangered Species Act of 1973.
Treatment best management practices (BMPs)	Actions that remove pollutants from runoff through one or more physical, chemical, biological mechanisms.
Unusual biological community types	Assemblages of interacting organisms that are relatively uncommon regionally.
Values	Wetland processes or attributes that are valuable or beneficial to society (also see Functions). Wetland values include support of commercial and sport fish and wildlife species, protection of life and property from flooding, recreation, education, and aesthetic enhancement of human communities.
Vernal wetland	A wetland that has water above the soil surface for a period of time during and/or after the wettest season but always dries to or below the soil surface in warmer, drier weather.
Wetland obligate	A biological organism that absolutely requires a wetland habitat for at least some stage of its life cycle.

Wetlands

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include, but are not limited to swamps, marshes, bogs, and similar areas, as well as artificial wetlands intentionally created from non-wetland areas to mitigate for conversion of wetlands, as permitted by the county. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to irrigation and drainage ditches, grass-lined biofiltration swales, canals, detention facilities, wastewater treatment facilities, farm ponds and landscaping amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. The detailed methodology for wetland delineation is contained in Washington State Wetlands Identification and Delineation Manual Washington State Department of Ecology, Publication #96-94, March 1997 Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands. See SCC 30.91W.060

Wetlands Guidance Appendix 3: Native and Recommended Noninvasive Plant Species for Wetlands in the Puget Sound Basin

Caution: Extracting plants from an existing wetland donor site can cause a significant negative effect on that site. It is recommended that plants be obtained from native plant nursery stocks whenever possible. Collections from existing wetlands should be limited in scale and undertaken with care to avoid disturbing the wetland outside of the actual point of collection. Plant selection is a complex task, involving matching plant requirements with environmental conditions. It should be performed by a qualified wetlands botanist. Refer to Restoring Wetlands in Washington by the Washington Department of Ecology for more information.

Plants preferred in freshwater wetlands

Open water zone

Tamogeton species (pondweeds)

Nymphaea odorata (pond lily)

Brasenia schreberi (watershield)

Nuphar luteum (yellow pond lily)

Polygonum hydropiper (smartweed)

Alisma plantago-*aquatica* (broadleaf water plantain)

Ludwigia palustris (water purslane)

Menyanthes trifoliata (bogbean)

Utricularia minor, U. vulgaris (bladderwort)

Emergent zone:

Carex obnupta, C. utriculata, C. arcta, C. stipata, C. vesicaria C. aquatilis, C. comosa, C. lenticularis (sedge)

Scirpus atricinctus (woolly bulrush)

Scirpus microcarpus (small-fruited bulrush)

Eleocharis palustris, E. ovata (spike rush)

Epilobium watsonii (Watson's willow herb)

Typha latifolia (common cattail) (Note: This native plant can be aggressive but has been found to offer certain wildlife habitat and water quality improvement benefits; use with care.)

Veronica americana, V. scutellata (American brookline, marsh speedwell)

Mentha arvensis (field mint)

Lycopus americanus, L. uniflora (bugleweed or horehound)

Angelica species (angelica)

Oenanthe sarmentosa (water parsley)

Heracleum lanatum (cow parsnip)

Glyceria grandis, G. elata (manna grass)

Juncus acuminatus (tapertip rush)

Juncus ensifolius (daggerleaf rush)

Juncus bufonius (toad rush)

Mimulus guttatus (common monkey flower)

Scrub-shrub zone

Salix lucida, S. rigida, S. sitchensis, S. scouleriana, S. pedicellaris (willow)

Lysichiton americanus (skunk cabbage)

Athyrium filix-femina (lady fern)

Cornus sericea (redstem dogwood)

Rubus spectabilis (salmonberry)

Physocarpus capitatus (ninebark)

Ribes species (gooseberry)

Rhamnus purshiana (cascara)

Sambucus racemosa (red elderberry) (occurs in wetland-upland transition)

Loniceria involucrata (black twinberry)

Oemleria cerasiformis (Indian plum)

Stachys cooleyae (Stachy's horsemint)

Prunus emarginata (bitter cherry)

Forested zone:

Populus balsamifera, ssp. trichocarpa (black cottonwood)

Fraxinus latifolia (Oregon ash)

Thuja plicata (western red cedar)

Picea sitchensis (Sitka spruce)

Alnus rubra (red alder)

Tsuga heterophylla (hemlock)

Acer circinatum (vine maple)

Maianthemum dilatatum (wild lily-of-the-valley)

Ivzula parviflora (small-flower wood rush)

Torreyochloa pauciflora (weak alkaligrass)

Ribes species (currants)

Bog:

Sphagnum species (sphagnum mosses)

Rhododendron groenlandicum (Labrador tea)

Vaccinium oxycoccos (bog cranberry)

Kalmia microphylla, ssp. *occidentalis* (bog laurel)

Exotic plans that should NOT be introduced to existing, created, or constructed freshwater wetlands

English ivy

Reed canarygrass

Purple loosestrife

Yellow iris

Ilex aquifolia (holly)

Impatiens glandulifera (policeman's helmet)

Lotus corniculatus (birdsfoot trefoil)

Lysimachia thyrsiflora (tufted loosestrife)

Myriophyllum species (water milfoil, parrot's feather)

Polygonum cuspidatum (Japanese knotweed)

Polygonum sachalinense (giant knotweed)

Rubus discolor (Himalayan blackberry)

Tanacetum vulgare (common tansy)

Native plants that should not be introduced to existing, created, or constructed freshwater wetlands

Soft rush

Poison hemlock

Potentilla palustris (Pacific silverweed

Bittersweet nightshade

Ranunculus repens (creeping buttercup)

Wetlands Guidance Appendix 4: Comparison of Water Chemistry Characteristics In Sphagnum Bog And Fen Versus More Typical Wetlands

Water Quality Variable	**Typical Wetlands**	***Sphagnum* Bogs and Fens**
PH	6 - 7	3.5 - 4.5
Dissolved oxygen (mg/L)	4 - 8	Shallow surface layer oxygenated, anoxic below
Cations	Divalent Ca, Mg common	Divalent Ca, Mg uncommon; Univalent Na, K predominant
Anions	HCO_3^-, CO_3^{2-} predominant	Cl^-, SO_4^{2-} predominant; almost no HCO_3^-, CO_3^{2-} (organic acids form buffering system)
Hardness	Moderate	Very low
Total phosphorus (µg/L)	50 - 500	5 - 50
Total Kjeldahl nitrogen (µg/L)	500 - 1000	~ 50

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Appendix I-E
Surface Waters Exempt From Flow Control Requirements

Stormwater discharges subject to the flow control requirements of SCC 30.63A.550 through SCC 30.63A.560, are exempt from these requirements if they are discharged to the following water bodies, provided that the discharges meet the conditions set forth in this appendix.

Snohomish County Surface Waters Exempt From Flow Control Requirements

Water Body	Upstream Point/Reach for Exemption (if applicable)
Sauk River	Downstream of confluence of South Fork and North Fork
Sauk River, North Fork	North Fork Sauk River at Bedal Campground
Skykomish River	Downstream of South Fork
Skykomish River, South Fork	Downstream of confluence of Tye and Foss Rivers
Snohomish River	Downstream of confluence of Snoqualmie and Skykomish Rivers
Snoqualmie River	Downstream of confluence of the Middle Fork
Snoqualmie River, Middle Fork	Downstream of confluence with Rainy Creek
Stillaguamish River	Downstream of confluence of North and South Fork
Stillaguamish River, North Fork	7.7 highway miles west of Darrington on SR530, downstream of confluence with French Creek.
Stillaguamish River, South Fork	7 Downstream of confluence of Cranberry Creek and South Fork
Suiattle River	Downstream of confluence with Milk Creek
Sultan River	0.4 miles upstream of SR2

Conditions for exemption

All of the following conditions must be met for discharges to be exempt from SCC 30.63A.550 through SCC 30.63A.560.

- Direct discharge to the exempt receiving water does not result in the diversion of drainage from any perennial stream classified as Types 1, 2, 3, or 4 in the State of Washington Interim Water Typing System, or Types “S”, “F”, or “Np” in the Permanent Water Typing System, or from any category I, II, or III wetland.
- Flow splitting devices or drainage BMP’s are applied to route natural runoff volumes from the project site to any downstream Type 5 stream or category IV wetland:
    - Design of flow splitting devices or drainage BMP’s will be based on continuous hydrologic modeling analysis. The design will assure that flows delivered to Type 5 stream reaches will approximate, but in no case exceed, durations ranging from 50% of the 2-year to the 50-year peak flow.

- Flow splitting devices or drainage BMP's that deliver flow to category IV wetlands will also be designed using continuous hydrologic modeling to preserve pre-project wetland hydrologic conditions unless specifically waived or exempted by regulatory agencies with permitting jurisdiction.

- The project site must be drained by a conveyance system that is composed entirely of manmade conveyance elements (e.g., pipes, ditches, outfall protection, etc.) and extends to the ordinary high water line of the exempt receiving water.
- The conveyance system between the project site and the exempt receiving water shall have a hydraulic capacity sufficient to convey discharges from future build-out conditions (under current zoning) of the site, and the existing condition from non-project areas from which runoff is or will be collected.
- Any erodible elements of the manmade conveyance system must be adequately stabilized to prevent erosion under the conditions noted above.

Appendix I-F
Stormwater Pollution Prevention Plan (SWPPP) Submittal Requirements for Small Projects Pursuant to SCC 30.63A.810

Introduction

This appendix provides requirements for selecting best management practices (BMPs) for Stormwater Pollution Prevention Plans (SWPPPs) for small projects that meet the criteria set forth in SCC 30.63A.810. If required, applicants shall use the small project SWPPP drainage review forms provided by Snohomish County Department of Planning and Development Services.

These projects are required to comply with Minimum Requirement 2 - Stormwater Pollution Prevention, and a key criterion of these projects is that they do not require the stamp of a licensed civil engineer. Consequently, the applicant must be able to meet all requirements of Minimum Requirement 2 by using the erosion control BMPs listed in this appendix. The BMPs listed in this appendix do not require an engineer's stamp.

The following sections contain:

- A review of the twelve elements of Minimum Requirement 2, and the erosion control BMPs allowable for small projects to meet these requirements
- Required sequence of BMP implementation

Elements of Minimum Requirement 2 and allowable erosion control BMPs

The twelve elements of Minimum Requirement 2 are:

1. Mark clearing limits
2. Establish construction access
3. Control flow rates
4. Install sediment controls
5. Stabilize soils
6. Protect slopes
7. Protect drain inlets
8. Stabilize channels and outlets
9. Control pollutants
10. Control dewatering
11. Maintain BMPs
12. Manage the project

The measures used to meet these twelve elements must be described or shown in drawing form in the Stormwater Pollution Prevention Plan (SWPPP). For details on how these elements are

implemented on larger projects, see SCC 30.63A.445 to SCC 30.63A.510 and Volume II, Chapter 3.2.3.

SWPPP element 1: preserve vegetation/mark clearing limits

Minimize removal of existing trees and disturbance and compaction of native soils, except as needed for building purposes. The duff layer, native top soil, and natural vegetation shall be retained in an undisturbed state to the maximum degree practicable. Plan and implement proper clearing and grading of the site. Clear only the areas needed, thus keeping exposed areas to a minimum. Phase clearing so that only those areas that are actively being worked are uncovered. Soil shall be managed in a manner that does not permanently compact or deteriorate the final soil and landscape system. If disturbance and/or compaction occur the impact must be corrected at the end of the construction activity. This shall include restoration of soil depth, soil quality, permeability, and percent organic matter. Construction practices must not cause damage to or compromise the design of permanent landscape or infiltration areas.

Prior to beginning land disturbing activities, delineate or mark the following areas and features on the site:

(a) Clearing limits;

(b) All critical areas, and their setbacks and buffers;

(c) Erosion or landslide hazard areas and their setbacks and buffers;

(d) Existing and proposed easements;

(e) Required landscaping, and tree retention and replacement areas;

(f) Other areas on the site required to be preserved or protected including, but not limited to, drainage courses.

Relevant BMPs:

- BMP C101: Preserving Natural Vegetation
- BMP C102: Buffer Zones
- BMP C103: High Visibility Plastic or Metal Fence
- BMP C104: Stake and Wire Fence

SWPPP element 2: establish construction access

Construction vehicle ingress and egress shall be limited to one route if possible. A stabilized construction entrance or other equivalent BMP shall be installed to prevent sediment transport onto roads.

Streets shall be cleaned at the end of each day during dry weather and more frequently during wet weather. Street washing is only allowed after sediment is removed by shoveling or pick-up sweeping and transported to a controlled disposal area. Street wash wastewater shall be controlled by pumping it back on site or otherwise preventing its discharge into systems tributary to the waters of the state or waters that would otherwise require enhanced treatment.

Relevant BMPs:

- BMP C105: Stabilized Construction Entrance
- BMP C107: Construction Road/Parking Area Stabilization

SWPPP element 3: control flow rates

Small projects shall meet this requirement by appropriate use of BMPs related to SWPPP element 4.

SWPPP element 4: install sediment controls

Remove sediment from construction site runoff by using appropriate sediment removal BMPs. Runoff from fully stabilized areas may be discharged without a sediment removal BMP.

Relevant BMPs:

- BMP C230: Straw Bale Barrier
- BMP C231: Brush Barrier
- BMP C232: Gravel Filter Berm
- BMP C233: Silt Fence
- BMP C234: Vegetated Strip
- BMP C235: Straw Wattles

SWPPP element 5: stabilize soils

Exposed and unworked soils and soil stockpiles shall be stabilized. Soil stockpiles shall be located away from storm drain inlets, drainage channels and other waters.

The time period of soil exposure allowed depends on the season. No soils shall remain exposed and unworked for more than seven days during the dry season, May 1 through September 30, or two days during the wet season, October 1 through April 30, unless the County places other restrictions on the project.

Locate excavated basement soil a reasonable distance behind the curb, such as in the backyard or side yard area. This will increase the distance eroded soil must travel to reach the storm sewer system. Soil piles should be covered until the soil is either used or removed. Piles should be situated so that sediment does not run into the street or adjoining yards. Backfill basement walls as soon as possible and rough grade the lot. This will eliminate large soil mounds, which are highly erodible, and prepares the lot for temporary cover, which will further reduce erosion potential

Remove excess soil from the site as soon as possible after backfilling. This will eliminate any sediment loss from surplus fill.

If a lot has a soil bank higher than the curb, a trench or berm should be installed moving the bank several feet behind the curb. This will reduce the occurrence of gully and rill erosion while providing a storage and settling area for stormwater.

Relevant BMPs:

- BMP C120: Temporary and Permanent Seeding
    - *NOTE: small projects shall only use methods in BMP C120 that do not require engineering.*
- BMP C121: Mulching
- BMP C122: Nets and Blankets
- BMP C123: Plastic Covering
- BMP C124: Sodding
- BMP C125: Topsoiling (for soil stabilization)
- BMP C131: Gradient Terraces
- BMP C140: Dust Control

SWPPP Element 6: protect slopes

NOTE: Cut and fill slopes may require engineering, pursuant to SCC 30.63B.110, SCC 30.63B.130, SCC 30.63B.200. In addition, most of the BMPs related to this SWPPP element require engineering. If cut or fill slopes are proposed, the applicant should verify that the project meets the small project criteria.

Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion and comply with the County's applicable critical area regulations. Cut and fill slopes shall be protected from erosive flows and concentrated flows until permanent cover and drainage conveyance systems are in place. Excavated material shall be placed on the uphill side of trenches, consistent with safety and space considerations.

Relevant BMPs:

- BMP C120: Temporary and Permanent Seeding
    - *NOTE: small projects shall only use methods in BMP C120 that do not require engineering.*
- BMP C208: Triangular Silt Dike (Geotextile-Encased Check Dam)

SWPPP element 7: protect permanent drain inlets.

All permanent storm drain inlets require protection from sediment and silt-laden water. Permanent storm drain inlets operable on the site during construction shall be protected so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment. Inlet protection devices shall be cleaned or removed and replaced when sediment has filled one-third of the available storage or as specified by the product manufacturer. They may be removed once the site is stabilized.

Relevant BMPs:

- BMP C220: Storm Drain Inlet Protection

SWPPP element 8: stabilize channels and outlets

NOTE: Design and construction of stormwater conveyance systems requires an engineer per SCC 30.63A.400(3)(d). In addition, the BMPs related to this SWPPP element require engineering. The channel and outlet stabilization measures proposed herein are intended for protection of preexisting drainage systems on the project site, and the project applicant should verify with the County that the project meets the small project criteria.

Temporary and permanent conveyance systems shall be stabilized to prevent erosion during and after construction. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream reaches shall be provided at the outlets of all conveyance systems.

Relevant BMPs:

- BMP C202: Channel Lining
- BMP C209: Outlet Protection

SWPPP element 9: control pollutants

Appropriate pollution source control measures shall be implemented in areas of: construction equipment maintenance or fueling; handling or storage of waste materials, construction debris, fertilizers, chemicals; and other activities that may contribute pollutants to stormwater. The following specific requirements apply.

- Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment.
- On-site fueling tanks shall include secondary containment.
- Maintenance, fueling and repair of heavy equipment and vehicles shall be conducted using spill prevention and control measures consistent with Volume IV, Chapters 2 and 3.
- Contaminated surfaces shall be cleaned immediately following any spill incident.
- Application of fertilizers and pesticides shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' label requirements for application rates and procedures shall be followed
- BMPs shall be used to prevent contamination of stormwater runoff by pH modifying sources. These sources include, but are not limited to, bulk cement, cement kiln dust, fly ash, new concrete washing approved treatment, curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters.

Relevant BMPs:

- BMP C151: Concrete Handling
- BMP C152: Sawcutting and Surfacing Pollution Prevention
- BMP C 153: Material Storage, Delivery, and Containment

See also Volume IV of this manual

SWWP element 10: control dewatering

NOTE: Many of the BMPs related to this SWPPP element require engineering; however most small projects stormwater runoff will be dispersed on site to natural vegetation, to a containment vessel or sewer system with permission of the utility company. In these cases, this BMP may not be applicable. The project applicant should verify with the County that the project meets the small project criteria.

Turbid or contaminated dewatering water shall be handled separately from stormwater, and shall be collected for off-site disposal in a legal manner, or discharged to a sanitary sewer contingent

on local sewer district approval. Uncontaminated or clean water from dewatering systems for trenches, vaults and foundations may be disposed by on-site infiltration or use of a catch basin insert or with outfall to a ditch or swale for small volumes of dewatering water.

Relevant BMPs

- BMP C220 - Storm Drain Inlet Protection

SWPPP element 11: maintain best management practices.

BMPs shall be inspected and maintained during construction and removed within 30 days after the County determines that the site is stabilized, provided that temporary BMPs may be removed when they are no longer needed.

SWPPP element 12: manage the project.

The SWPPP shall be fully implemented at all times and modified whenever there is a change in design, construction, operation, or maintenance at the construction site that has or could have a significant effect on the discharge of pollutants to waters of the state.

Sequence of BMP Implementation

Erosion control BMPs should be implemented in the following sequence:

1) Delineate or mark the following areas and features on the site:
   (a) Clearing limits;
   (b) Critical areas and their buffers;
   (c) Erosion or landslide hazard areas and their setbacks;
   (d) Easements;
   (e) Required landscaping, and tree retention and replacement areas;
   (f) Other areas on the site required to be preserved or protected including, but not limited to, drainage courses.
2) Install stabilized construction entrance and parking area stabilization.
3) Protect existing drainage systems on site.
4) Establish areas for storage and handling of polluted materials at which pollution source control BMPs will be implemented.
5) Install sediment controls.
6) Implement stabilization measures for disturbed areas, slopes, and material stockpiles.
7) Maintain BMPs until final site stabilization.

Glossary and Notations

The following terms are provided for reference and use with this manual. They shall be superseded by any other definitions for these terms adopted by Snohomish County Code or Snohomish County EDDS.

AASHTO classification — The official classification of soil materials and soil aggregate mixtures for highway construction, used by the American Association of State Highway and Transportation Officials.

Absorption — The penetration of a substance into or through another, such as the dissolving of a soluble gas in a liquid.

Adjacent steep slope — A slope with a gradient of 15 percent or steeper within five hundred feet of the site.

Adsorption — The adhesion of a substance to the surface of a solid or liquid; often used to extract pollutants by causing them to be attached to such adsorbents as activated carbon or silica gel. Hydrophobic, or water-repulsing adsorbents, are used to extract oil from waterways when oil spills occur. Heavy metals such as zinc and lead often adsorb onto sediment particles.

Aeration — The process of being supplied or impregnated with air. In waste treatment, the process used to foster biological and chemical purification. In soils, the process by which air in the soil is replenished by air from the atmosphere. In a well aerated soil, the soil air is similar in composition to the atmosphere above the soil. Poorly aerated soils usually contain a much higher percentage of carbon dioxide and a correspondingly lower percentage of oxygen.

Aerobic — Living or active only in the presence of free (dissolved or molecular) oxygen.

Aerobic bacteria — Bacteria that require the presence of free oxygen for their metabolic processes.

Aggressive plant species — Opportunistic species of inferior biological value that tend to out-compete more desirable forms and become dominant; applied to native species in this manual.

Algae	Primitive plants, many microscopic, containing chlorophyll and forming the base of the food chain in aquatic environments. Some species may create a nuisance when environmental conditions are suitable for prolific growth.
Algal bloom	Proliferation of living algae on the surface of lakes, streams or ponds; often stimulated by phosphate over-enrichment. Algal blooms reduce the oxygen available to other aquatic organisms.
American Public Works Association (APWA)	The Washington State Chapter of the American Public Works Association.
Anadromous	Fish that grow to maturity in the ocean and return to rivers for spawning.
Anaerobic	Living or active in the absence of oxygen.
Anaerobic bacteria	Bacteria that do not require the presence of free or dissolved oxygen for metabolism.
Annual flood	The highest peak discharge on average which can be expected in any given year.
Antecedent moisture conditions	The degree of wetness of a watershed or within the soil at the beginning of a storm.
Anti-seep collar	A device constructed around a pipe or other conduit and placed through a dam, levee, or dike for the purpose of reducing seepage losses and piping failures.
Anti-vortex device	A facility placed at the entrance to a pipe conduit structure such as a drop inlet spillway or hood inlet spillway to prevent air from entering the structure when the pipe is flowing full.
Applicant	The person who has applied for a development permit or approval.
Appurtenances	Machinery, appliances, or auxiliary structures attached to a main structure, but not considered an integral part thereof, for the purpose of enabling it to function.
Aquifer	A geologic stratum containing ground water that can be withdrawn and used for human purposes.
Arterial	See Chapter 30.91A.270 SCC. A transportation facility designated as an arterial in an UGA plan or the comprehensive plan.

As-built drawings	Engineering plans which have been revised to reflect all changes to the plans which occurred during construction.
As-graded	The extent of surface conditions on completion of grading.
BSBL	See Building set back line.
Background	A description of pollutant levels arising from natural sources, and not because of man's immediate activities.
Background water quality	See Chapter 30.91B.010 SCC. "Background water quality" means the concentrations of chemical, physical, biological, or radiological constituents, or other characteristics in or of groundwater at a particular point in time and upgradient of an activity that have not been affected by that activity.
Backwater	Water upstream from an obstruction which is deeper than it would normally be without the obstruction.
Baffle	A device to check, deflect, or regulate flow.
Bankfull discharge	A flow condition where streamflow completely fills the stream channel up to the top of the bank. In undisturbed watersheds, the discharge conditions occur on average every 1.5 to 2 years and controls the shape and form of natural channels.
Base flood	See SCC 30.91B.020.The flood having a one percent chance of being equaled or exceeded in any given year.
Base flood elevation	The water surface elevation of the base flood. It shall be referenced to the National Geodetic Vertical Datum of 1929 (NGVD).
Baseline sample	A sample collected during dry-weather flow (i.e., it does not consist of runoff from a specific precipitation event).

Basin plan

A plan that assesses, evaluates, and proposes solutions to existing and potential future impacts to the beneficial uses of, and the physical, chemical, and biological properties of waters of the state within a basin. Basins typically range in size from 1 to 50 square miles. A plan should include but not be limited to recommendations for:

- Stormwater requirements for new development and redevelopment;
- Capital improvement projects;
- Land Use management through identification and protection of critical areas, comprehensive land use and transportation plans, zoning regulations, site development standards, and conservation areas;
- Source control activities including public education and involvement, and business programs;
- Other targeted stormwater programs and activities, such as maintenance, inspections and enforcement;
- Monitoring; and
- An implementation schedule and funding strategy.

A plan that is "adopted and implemented" must have the following characteristics:

- It must be adopted by legislative or regulatory action of jurisdictions with responsibilities under the plan;
- Ordinances, regulations, programs, and procedures recommended by the plan should be in effect or on schedule to be in effect; and,
- An implementation schedule and funding strategy that are in progress.

Bearing capacity

The maximum load that a material can support before failing.

Bedrock

The more or less solid rock in place either on or beneath the surface of the earth. It may be soft, medium, or hard and have a smooth or irregular surface.

Bench

A relatively level step excavated into earth material on which fill is to be placed.

Berm

A constructed barrier of compacted earth, rock, or gravel. In a stormwater facility, a berm may serve as a vertical divider typically built up from the bottom.

Best management practices (BMPs)

See SCC 30.91B.080. The schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State.

Biochemical oxygen demand (BOD)

An indirect measure of the concentration of biologically degradable materials present in organic wastes. The amount of free oxygen utilized by aerobic organisms when allowed to attack the organic material in an aerobically maintained environment at a specified temperature (20°C) for a specific time period (5 days), and thus stated as BOD5. It is expressed in milligrams of oxygen utilized per liter of liquid waste volume (mg/l) or in milligrams of oxygen per kilogram of waste solution (mg/kg = ppm = parts per million parts). Also called biological oxygen demand.

Biodegradable

Capable of being readily broken down by biological means, especially by microbial action. Microbial action includes the combined effect of bacteria, fungus, flagellates, amoebae, ciliates, and nematodes. Degradation can be rapid or may take many years depending upon such factors as available oxygen and moisture.

Bioengineering

The combination of biological, mechanical, and ecological concepts (and methods) to control erosion and stabilize soil through the use of vegetation or in combination with construction materials.

Biofilter

A designed treatment facility using a combined soil and vegetation system for filtration, infiltration, adsorption, and biological uptake of pollutants in stormwater when runoff flows over and through. Vegetation growing in these facilities acts as both a physical filter which causes gravity settling of particulates by regulating velocity of flow, and also as a biological sink when direct uptake of dissolved pollutants occurs. The former mechanism is probably the most important in western Washington where the period of major runoff coincides with the period of lowest biological activity.

Biofiltration

See SCC 30.91B.130.The process of reducing pollutant concentrations in water by filtering through biological materials.

Biological control

A method of controlling pest organisms by means of introduced or naturally occurring predatory organisms, sterilization, the use of inhibiting hormones, or other means, rather than by mechanical or chemical means.

Biological Magnification	The increasing concentration of a substance along succeeding steps in a food chain. Also called biomagnification.
Bollard	See SCC 30.91B.175. A rigid post, permanent or removable, used as a traffic control device to limit vehicle access. Bollards are usually installed in a line with sufficient space between them to allow permitted access, such as bicycles and pedestrians, but not motor vehicles. Removable bollards are used when access may be required for special-purpose vehicles but not general traffic.
Bond	A surety bond, cash deposit or escrow account, assignment of savings, irrevocable letter of credit or other means acceptable to or required by the manager to guarantee that work is completed in compliance with the project's drainage plan and in compliance with all local government requirements.
Borrow area	A source of earth fill material used in the construction of embankments or other earth fill structures.
Buffer	The zone contiguous with a critical area that is required for the continued maintenance, function, and structural stability of the critical area. The critical functions of a riparian buffer (those associated with an aquatic system) include shading, input of organic debris and coarse sediments, uptake of nutrients, stabilization of banks, interception of fine sediments, overflow during high water events, protection from disturbance by humans and domestic animals, maintenance of wildlife habitat, and room for variation of aquatic system boundaries over time due to hydrologic or climatic effects. The critical functions of terrestrial buffers include protection of slope stability, attenuation of surface water flows from stormwater runoff and precipitation, and erosion control.
Building Setback Line (BSBL)	A line measured parallel to a property, easement, drainage facility, or buffer boundary, that delineates the area (defined by the distance of separation) where buildings or other obstructions are prohibited (including decks, patios, outbuildings, or overhangs beyond 18 inches). Wooden or chain link fences and landscaping are allowable within a building setback line. In this manual the minimum building setback line shall be 5 feet.
CIP	See Capital Improvement Project.

Capital Improvement Project or Program (CIP)	A project prioritized and scheduled as a part of an overall construction program or, the actual construction program.
Catch basin	A chamber or well, usually built at the curb line of a street, for the admission of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.
Catchline	The point where a severe slope intercepts a different, more gentle slope.
Catchment	Surface drainage area.
Cation Exchange Capacity (CEC)	The amount of exchangeable cations that a soil can adsorb at pH 7.0.
Certified Erosion And Sediment Control Lead (CESCL)	See SCC 30.91C.066. An individual who has current certification through an approved erosion and sediment control training program that meets the minimum training standards established by the Department of Ecology (see BMP C160 in the Drainage Manual). A CESCL is knowledgeable in the principles and practices of erosion and sediment control. The CESCL must have the skills to assess site conditions and construction activities that could impact the quality of stormwater and, the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
Channel	A feature that conveys surface water and is open to the air.
Channel, constructed	Channels or ditches constructed (or reconstructed natural channels) to convey surface water.
Channel, natural	Streams, creeks, or swales that convey surface/ground water and have existed long enough to establish a stable route and/or biological community.
Channel stabilization	Erosion prevention and stabilization of velocity distribution in a channel using vegetation, jetties, drops, revetments, and/or other measures.
Channel storage	Water temporarily stored in channels while enroute to an outlet.

Channelization Alteration of a stream channel by widening, deepening, straightening, cleaning, or paving certain areas to change flow characteristics.

Check dam Small dam constructed in a gully or other small watercourse to decrease the streamflow velocity, minimize channel scour, and promote deposition of sediment

Chemical oxygen demand (COD) A measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water. The COD test, like the BOD test, is used to determine the degree of pollution in water.

Civil engineer See SCC 30.91C.090. A professional engineer licensed by the state of Washington to practice in the field of civil engineering.

Civil engineering See SCC 30.91C.100.The application of the knowledge of the forces of nature, principles of mechanics and the properties of materials to the evaluation, design and construction of civil works.

Clay lens A naturally occurring, localized area of clay which acts as an impermeable layer to runoff infiltration.

Clearing See SCC 30.91C.112. The destruction or surface removal of vegetation by cutting, pruning, limbing, topping, relocating manually or mechanically, application of herbicides or pesticides or other chemical methods, or any application of hazardous or toxic substance that has the effect of destroying or removing the vegetation.

Closed depression An area which is low-lying and either has no, or such a limited, surface water outlet that during storm events the area acts as a retention basin.

Cohesion The capacity of a soil to resist shearing stress, exclusive of functional resistance.

Coliform bacteria Microorganisms common in the intestinal tracts of man and other warm-blooded animals; all the aerobic and facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. Used as an indicator of bacterial pollution.

Compaction The densification, settlement, or packing of soil in such a way that permeability of the soil is reduced. Compaction effectively shifts the performance of a hydrologic group to a lower permeability hydrologic group. For example, a group B hydrologic soil can be compacted and be effectively converted to a group C hydrologic soil in the way it performs in regard to runoff.

	Compaction may also refer to the densification of a fill by mechanical means.
Compensatory storage	New excavated storage volume equivalent to the flood storage capacity eliminated by filling or grading within the flood fringe. Equivalent shall mean that the storage removed shall be replaced by equal volume between corresponding one-foot contour intervals that are hydraulically connected to the floodway through their entire depth.
Compost	Organic residue or a mixture of organic residues and soil, that has undergone biological decomposition until it has become relatively stable humus. Reference note: The Department of Ecology Interim Guidelines for Compost Quality (1994) defines compost as "the product of composting; it has undergone an initial, rapid stage of decomposition and is in the process of humification (curing)." Compost used should meet specifications for grade A or AA compost in Ecology publication 94-038.
Composted Mulch	Mulch prepared from decomposed organic materials that have undergone a controlled process to minimize weed seeds. Acceptable feedstocks include, but are not limited to, yard debris, wood waste, land clearing debris, brush, and branches.
Composting	A controlled process of degrading organic matter by microorganisms. Present day composting is the aerobic, thermophilic decomposing of organic waste to relatively stable humus. Composting is the process of making usable, organic matter that is beneficial to plants and has converted nutrients into slow-release forms (versus mineralized water-soluble forms found in fertilizer).
Comprehensive Planning	Planning that takes into account all aspects of water, air, and land resources and their uses and limits.
Conservation district	A public organization created under state enabling law as a special-purpose district to develop and carry out a program of soil, water, and related resource conservation, use, and development within its boundaries, usually a subdivision of state government with a local governing body and always with limited authority. Often called a soil conservation district or a soil and water conservation district.
Constructed wetland	Those wetlands intentionally created on sites that are not wetlands for the primary purpose of wastewater or stormwater treatment and

	managed as such. Constructed wetlands are normally considered as part of the stormwater collection and treatment system.
Contour	An imaginary line on the surface of the earth connecting points of the same elevation.
Conveyance	A mechanism for transporting water from one point to another, including pipes, ditches, and channels.
Conveyance system	See SCC 30.91C.300. A system of drainage facilities, natural, or artificial which collects, contains and conducts the flow of storm water runoff. The elements of a natural conveyance system include, but are not limited to, swales, wetlands, drainage courses, streams, and rivers. The elements of an artificial conveyance system include, but are not limited to, gutters, ditches, pipes, constructed open channels and detention facilities.
Cover crop	A close-growing crop grown primarily for the purpose of protecting and improving soil between periods of permanent vegetation.
Created wetland	Means those wetlands intentionally created from nonwetland sites to produce or replace natural wetland habitat (e.g., compensatory mitigation projects).
Critical area	See SCC 30.91C.340. Critical area means the following areas: (1) Wetlands; (2) Areas with a critical recharging effect on aquifers used for potable water, including: (a) Sole source aquifers, (b) Group A well head protection areas, and (c) Critical aquifer recharge areas; (3) Fish and wildlife habitat conservation areas, including: (a) Streams, (b) Lakes, (c) Marine waters, and (d) Primary association areas for critical species; (4) Frequently flooded areas; and (5) Geologically hazardous areas, including: (a) Erosion hazard areas, (b) Landslide hazard areas,

(c) Seismic hazard areas,

(d) Mine hazard areas,

(e) Volcanic hazard areas, and

(f) Tsunami hazard areas.

Critical Drainage Area — An area with such severe flooding, drainage and/or erosion/sedimentation conditions that the area has been formally adopted as a Critical Drainage Area by rule under the procedures specified in an ordinance.

Critical reach — The point in a receiving stream below a discharge point at which the lowest dissolved oxygen level is reached and stream recovery begins.

Culvert — Pipe or concrete box structure that drains open channels, swales or ditches under a roadway or embankment. Typically with no catchbasins or manholes along its length.

Cut — Portion of land surface or area from which earth has been removed or will be removed by excavating; the depth below original ground surface to excavated surface.

Cut-and-fill — Process of earth moving by excavating part of an area and using the excavated material for adjacent embankments or fill areas.

Cut slope — A slope formed by excavating overlying material to connect the original ground surface with a lower ground surface created by the excavation. A cut slope is distinguished from a bermed slope, which is constructed by importing soil to create the slope.

DNS — See Determination of Nonsignificance.

Dead storage — The volume available in a depression in the ground below any conveyance system, or surface drainage pathway, or outlet invert elevation that could allow the discharge of surface and stormwater runoff.

Dedication of land — Refers to setting aside a portion of a property for a specific use or function.

Degradation — (Biological or chemical) The breakdown of complex organic or other chemical compounds into simpler substances, usually less harmful than the original compound, as with the degradation of a persistent pesticide. (Geological) Wearing down by erosion. (Water) The lowering of the water quality of a watercourse by an increase in the pollutant loading.

Degraded (disturbed) wetland (community)	A wetland (community) in which the vegetation, soils, and/or hydrology have been adversely altered, resulting in lost or reduced functions and values; generally, implies topographic isolation; hydrologic alterations such as hydroperiod alteration (increased or decreased quantity of water), diking, channelization, and/or outlet modification; soils alterations such as presence of fill, soil removal, and/or compaction; accumulation of toxicants in the biotic or abiotic components of the wetland; and/or low plant species richness with dominance by invasive weedy species.
Denitrification	The biochemical reduction of nitrates or nitrites in the soil or organic deposits to ammonia or free nitrogen.
Depression storage	The amount of precipitation that is trapped in depressions on the surface of the ground.
Design engineer	The professional civil engineer licensed in the State of Washington who prepares the analysis, design, and engineering plans for an applicant's permit or approval submittal.
Design storm	See SCC 30.91D.160. A rainfall event of a size approved by the director, used for the purpose of sizing and designing drainage facilities, stated in terms of a recurrence interval and a time period over which the rainfall amount is measured or analyzed (i.e., a 2-year, 24-hour storm).
Detention	See SCC 30.91D.170.The temporary storage of storm water runoff to control peak discharge rates and allow settling of storm water sediment.
Detention facility	See SCC 30.91D.180. An open or closed drainage facility, such as a pond or tank, that temporarily stores storm water runoff and releases it at a slower rate than it is collected by the drainage facility. The facility includes the flow control structure, the inlet and outlet pipes, and all maintenance access points.
Detention time	The theoretical time required to displace the contents of a stormwater treatment facility at a given rate of discharge (volume divided by rate of discharge).
Determination of nonsignificance	See SCC 30.91D.300.The written decision by the responsible official of the lead agency that a proposal is not likely to have a significant adverse environmental impact, and therefore an EIS is not required. See WAC 197-11-734.

Development	Means new development, redevelopment, or both. See definitions for each.
Discharge	See SCC 30.91D.287.Runoff leaving a new development or redevelopment via overland flow, built conveyance systems, or infiltration facilities. A hydraulic rate of flow, specifically fluid flow; a volume of fluid passing a point per unit of time, commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, gallons per day, or millions of gallons per day.
Dispersion	Release of surface and stormwater runoff from a drainage facility system such that the flow spreads over a wide area and is located so as not to allow flow to concentrate anywhere upstream of a drainage channel with erodible underlying granular soils.
Ditch	A long narrow excavation dug in the earth for drainage with its top width less than 10 feet at design flow.
Divide, Drainage	The boundary between one drainage basin and another.
Drain	A buried pipe or other conduit (closed drain). A ditch (open drain) for carrying off surplus surface water or ground water.
(To) Drain	To provide channels, such as open ditches or closed drains, so that excess water can be removed by surface flow or by internal flow. To lose water (from the soil) by percolation.
Drainage	See SCC 30.91D.350. The collection, conveyance, containment, or discharge of storm water runoff
Drainage basin	See SCC 30.91D.360. A geographic and hydrologic area of a watershed or drainage catchment area.
Drainage channel	A drainage pathway with a well-defined bed and banks indicating frequent conveyance of surface and stormwater runoff.
Drainage course	A pathway for watershed drainage characterized by wet soil vegetation; often intermittent in flow.
Drainage easement	A legal encumbrance that is placed against a property's title to reserve specified privileges for the users and beneficiaries of the drainage facilities contained within the boundaries of the easement.
Drainage facility	See SCC 30.91D.370. A system of collecting, conveying and storing storm water runoff. Drainage facilities include, but are not limited to, all storm water conveyance systems and containment facilities including pipelines, channels, dikes, ditches, closed depressions, infiltration facilities, retention facilities, detention facilities, storm

water treatment facilities, erosion and sedimentation control facilities, and other drainage structures and appurtenances, both natural and artificial.

Drainage impacts See SCC 30.91D.380. The adverse impacts from changes to existing water quantity, rate or quality; water storage, retention and detention capacity, or water conveyance ability caused by a development activity; and may include, but are not limited to, flooding, erosion, sedimentation, scouring, bank sloughing, groundwater discharges to aquifer recharge areas, and adverse impacts to wetlands, fish and wildlife habitat conservation areas and geologically hazardous areas.

Drainage pathway The route that surface and stormwater runoff follows downslope as it leaves any part of the site.

Drainage review An evaluation by Plan Approving Authority staff of a proposed project's compliance with the drainage requirements in this manual or its technical equivalent.

Drainage, Soil As a natural condition of the soil, soil drainage refers to the frequency and duration of periods when the soil is free of saturation; for example, in well-drained soils the water is removed readily but not rapidly; in poorly drained soils the root zone is waterlogged for long periods unless artificially drained, and the roots of ordinary crop plants cannot get enough oxygen; in excessively drained soils the water is removed so completely that most crop plants suffer from lack of water. Strictly speaking, excessively drained soils are a result of excessive runoff due to steep slopes or low available water-holding capacity due to small amounts of silt and clay in the soil material. The following classes are used to express soil drainage:

Well drained - Excess water drains away rapidly and no mottling occurs within 36 inches of the surface.

- Moderately well drained - Water is removed from the soil somewhat slowly, resulting in small but significant periods of wetness. Mottling occurs between 18 and 36 inches.
- Somewhat poorly drained - Water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time. Mottling occurs between 8 and 18 inches.
- Poorly drained - Water is removed so slowly that the soil is wet for a large part of the time. Mottling occurs between 0 and 8 inches.
- Very poorly drained - Water is removed so slowly that the water table remains at or near the surface for the greater part of the time.

There may also be periods of surface ponding. The soil has a black to gray surface layer with mottles up to the surface.

Drawdown Lowering of the water surface (in open channel flow), water table or piezometric surface (in ground water flow) resulting from a withdrawal of water.

Drop-inlet spillway Overall structure in which the water drops through a vertical riser connected to a discharge conduit.

Drop spillway Overall structure in which the water drops over a vertical wall onto an apron at a lower elevation.

Drop structure A structure for dropping water to a lower level and dissipating its surplus energy; a fall. A drop may be vertical or inclined.

Dry weather flow The combination of groundwater seepage and allowed non-stormwater flows found in storm sewers during dry weather.. Also that flow in streams during the dry season.

EIS See Environmental Impact Statement.

ESC Erosion and Sediment Control (Plan).

Earth material See SCC 30.91E.020. Any rock, natural soil or fill or any combination thereof.

Easement See SCC 30.91E.030. A right granted by a property owner to specifically named parties or to the public for the use of certain land for specified purposes. Where appropriate to the context, "easement" may also refer to the land covered by the grant. This may include access, pedestrian paths, bicycle paths, utility easements, drainage, native growth protection areas, resource protection areas, critical area protection areas, or open space.

Effective impervious surface See SCC 30.91E.070. The portion of impervious surface producing runoff that cannot be infiltrated and upon which runoff cannot infiltrate, and that is connected via sheet flow or discrete conveyance to a drainage system. Impervious surfaces on residential development sites are considered ineffective if the runoff is dispersed through at least one hundred feet of native vegetation in accordance with BMP T5.30 in volume V, chapter 5 of the Drainage Manual.

Embankment A structure of earth, gravel, or similar material raised to form a pond bank or foundation for a road.

Emergent plants Aquatic plants that are rooted in the sediment but whose leaves are at or above the water surface. These wetland plants often have high habitat value for wildlife and waterfowl, and can aid in pollutant uptake.

Emergency spillway A vegetated earth channel used to safely convey flood discharges in excess of the capacity of the principal spillway.

Emerging technology Treatment technologies that have not been evaluated with approved protocols, but for which preliminary data indicate that they may provide a necessary function(s) in a stormwater treatment system. Emerging technologies need additional evaluation to define design criteria to achieve, or to contribute to achieving, state performance goals, and to define the limits of their use.

Energy dissipator Any means by which the total energy of flowing water is reduced. In stormwater design, they are usually mechanisms that reduce velocity prior to, or at, discharge from an outfall in order to prevent erosion. They include rock splash pads, drop manholes, concrete stilling basins or baffles, and check dams.

Energy gradient The slope of the specific energy line (i.e., the sum of the potential and velocity heads).

Engineered soil/ landscape system This is a self-sustaining soil and plant system that simultaneously supports plant growth, soil microbes, water infiltration, nutrient and pollutant adsorption, sediment and pollutant biofiltration, water interflow, and pollution decomposition. The system shall be protected from compaction and erosion. The system shall be planted and/or mulched as part of the installation.

The engineered soil/plant system shall have the following characteristics:

a. Be protected from compaction and erosion.

b. Have a plant system to support a sustained soil quality.

c. Possess permeability characteristics of not less than 6.0, 2.0, and 0.6 inches/hour for hydrologic soil groups A, B, and C, respectively (per ASTM D 3385). D is less than 0.6 inches/hour.

d. Possess minimum percent organic matter of 12, 14, 16, and 18 percent (dry-weight basis) for hydrologic soil groups A, B, C, and D, respectively (per ASTM D 2974).

Engineering geology	The application of geologic knowledge and principles in the investigation and evaluation of naturally occurring rock and soil for use in the design of civil works.
Engineering plan	A plan prepared and stamped by a professional civil engineer.
Enhancement	To raise value, desirability, or attractiveness of an environment associated with surface water.
Environmenta Impact Statement (EIS)	A document that discusses the likely significant adverse impacts of a proposal, ways to lessen the impacts, and alternatives to the proposal. They are required by the national and state environmental policy acts when projects are determined to have significant environmental impact.
Erodible Granular soils	Soil materials that are easily eroded and transported by running water, typically fine or medium grained sand with minor gravel, silt, or clay content. Such soils are commonly described as Everett or Indianola series soil types in the SCS classification. Also included are any soils showing examples of existing severe stream channel incision as indicated by unvegetated streambanks standing over two feet high above the base of the channel.
Erosion	See SCC 30.91E.150. The removal and loss of soil by the action of water, ice, or wind.
Erosion classes (soil survey)	A grouping of erosion conditions based on the degree of erosion or on characteristic patterns. Applied to accelerated erosion, not to normal, natural, or geological erosion. Four erosion classes are recognized for water erosion and three for wind erosion.
Erosion and Sedimentation Control	Any temporary or permanent measures taken to reduce erosion; control siltation and sedimentation; and ensure that sediment-laden water does not leave the site.

Erosion and sediment control facility	A type of drainage facility designed to hold water for a period of time to allow sediment contained in the surface and stormwater runoff directed to the facility to settle out so as to improve the quality of the runoff.
Escarpment	A steep face or a ridge of high land.
Estuarine wetland	Generally, an eelgrass bed; salt marsh; or rocky, sandflat, or mudflat intertidal area where fresh and salt water mix. (Specifically, a tidal wetland with salinity greater than 0.5 parts per thousand, usually semi-enclosed by land but with partially obstructed or sporadic access to the open ocean).
Estuary	An area where fresh water meets salt water, or where the tide meets the river current (e.g., bays, mouths of rivers, salt marshes and lagoons). Estuaries serve as nurseries and spawning and feeding grounds for large groups of marine life and provide shelter and food for birds and wildlife.
Eutrophication	Refers to the process where nutrient over-enrichment of water leads to excessive growth of aquatic plants, especially algae.
Evapotranspiration	The collective term for the processes of evaporation and plant transpiration by which water is returned to the atmosphere.
Excavation	See SCC 30.91E.220. The mechanical removal of earth material.
Exception	Relief from the application of a Minimum Requirement to a project.
Exfiltration	The downward movement of runoff through the bottom of an infiltration BMP into the soil layer or the downward movement of water through soil.
FIRM	See Flood Insurance Rate Map.
Fertilizer	Any material or mixture used to supply one or more of the essential plant nutrient elements.
Fill	See SCC 30.91F.210. A deposit of earth material placed by mechanical means.
Filter fabric	A woven or nonwoven, water-permeable material generally made of synthetic products such as polypropylene and used in stormwater management and erosion and sediment control applications to trap sediment or prevent the clogging of aggregates by fine soil particles.

Filter fabric fence A temporary sediment barrier consisting of a filter fabric stretched across and attached to supporting posts and entrenched. The filter fence is constructed of stakes and synthetic filter fabric with a rigid wire fence backing where necessary for support. Also commonly referred to in the Washington Department of Transportation standard specifications as "construction geotextile for temporary silt fences."

Filter strip A grassy area with gentle slopes that treats stormwater runoff from adjacent paved areas before it concentrates into a discrete channel.

Flocculation The process by which suspended colloidal or very fine particles are assembled into larger masses or floccules which eventually settle out of suspension. This process occurs naturally but can also be caused through the use of such chemicals as alum.

Flood or flooding See SCC 30.91F.360. A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland or tidal waters or the unusual and rapid accumulation of runoff of surface waters from any source.

Flood control Methods or facilities for reducing flood flows and the extent of flooding.

Flood control project A structural system installed to protect land and improvements from floods by the construction of dikes, river embankments, channels, or dams.

Flood frequency The frequency with which the flood of interest may be expected to occur at a site in any average interval of years. Frequency analysis defines the "n-year flood" as being the flood that will, over a long period of time, be equaled or exceeded on the average once every "n" years.

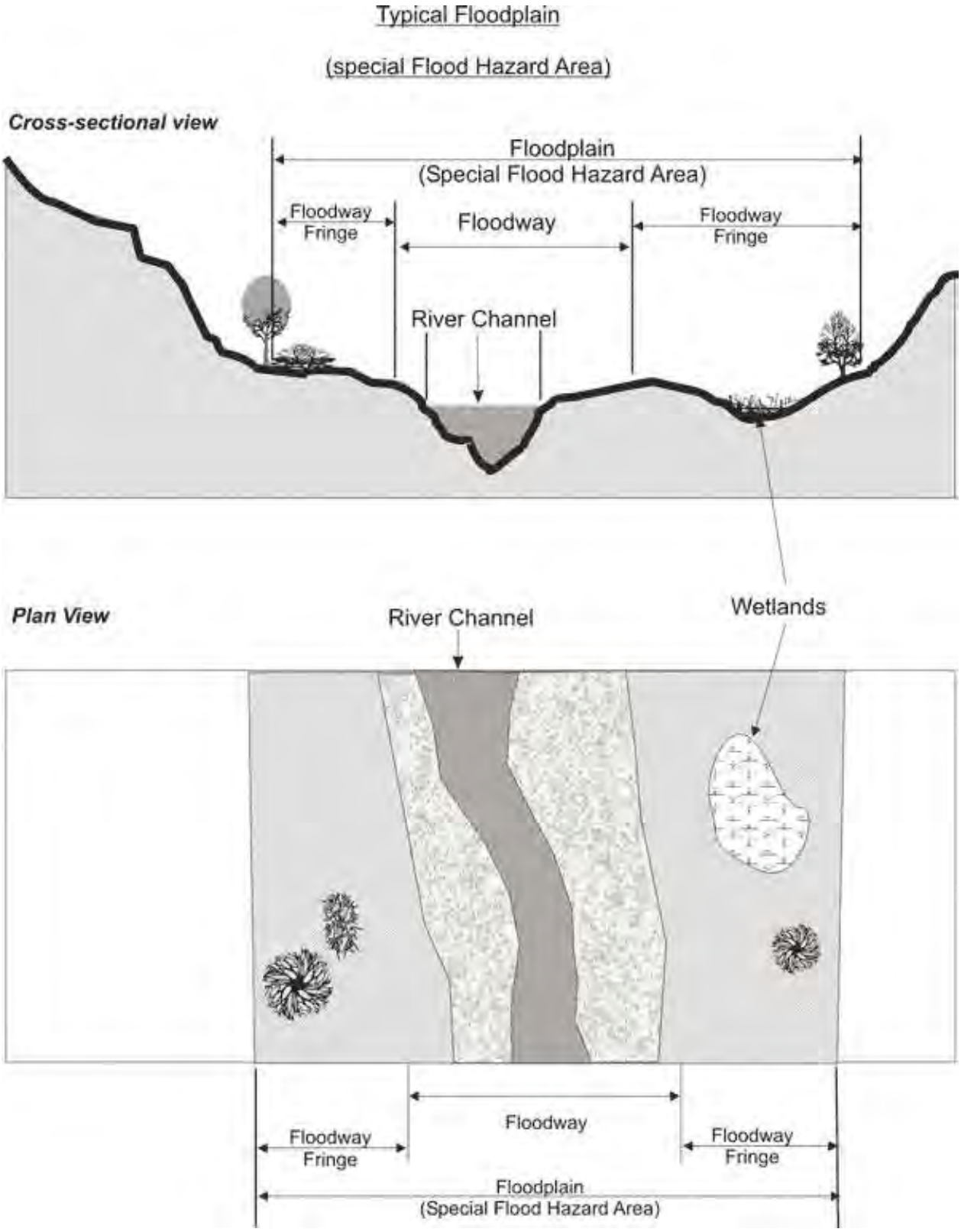
Flood fringe That portion of the floodplain outside of the floodway which is covered by floodwaters during the base flood; it is generally associated with slower moving or standing water rather than rapidly flowing water.

Flood hazard areas Those areas subject to inundation by the base flood. Includes, but is not limited to streams, lakes, wetlands, and closed depressions.

Flood insurance rate map See SCC 30.91F.390. The official map on which the federal insurance administration has delineated both the areas of special flood hazards and the risk premium zones applicable to the community

Flood insurance study	See SCC 30.91F.400. The official report provided by the federal insurance administration that includes flood profiles, the flood boundary-floodway map, and the water surface elevation of the base flood.
Flood peak	The highest value of the stage or discharge attained by a flood; thus, peak stage or peak discharge.
Floodplain	See SCC 30.91F.410. A land area adjoining a river, stream, watercourse, ocean, bay, or lake which is likely to be flooded. The extent of the floodplain may vary with the frequency of flooding being considered. The floodplain typically consists of the floodway and the floodway fringe. (See figure 30.91F.410 for illustration)

Figure 30.91F.410



Floodproofing	See SCC 30.91F.420. Any combination of structural and nonstructural additions, changes or adjustments to properties and structures which reduce or eliminate flood damages to lands, water and sanitary facilities, structures and contents of buildings.
Flood protection Elevation	The base flood elevation or higher as defined by the local government.
Flood protection Facility	Any levee, berm, wall, enclosure, raise bank, revetment, constructed bank stabilization, or armoring, that is commonly recognized by the community as providing significant protection to a property from inundation by flood waters.
Flood routing	An analytical technique used to compute the effects of system storage dynamics on the shape and movement of flow represented by a hydrograph.
Flood stage	The stage at which overflow of the natural banks of a stream begins.
Floodway	See SCC 30.91F.430. The regular channel of a river, stream, or other watercourse, plus the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. (See figure 30.91F.410 for illustration) .
Floodway fringe	See SCC 30.91F.440.That portion of a floodplain which is inundated by floodwaters but is not within a defined floodway. Floodway fringes serve as temporary storage areas for floodwaters. (See figure 30.91F.410 for illustration)
Flow control facility	A drainage facility designed to mitigate the impacts of increased surface and stormwater runoff flow rates generated by development. Flow control facilities are designed either to hold water for a considerable length of time and then release it by evaporation, plant transpiration, and/or infiltration into the ground, or to hold runoff for a short period of time, releasing it to the conveyance system at a controlled rate.
Flow duration	The aggregate time that peak flows are at or above a particular flow rate of interest. For example, the amount of time that peak flows are at or above 50% of the 2-year peak flow rate for a period of record.
Flow frequency	The inverse of the probability that the flow will be equaled or exceeded in any given year (the exceedance probability). For example, if the exceedance probability is 0.01 or 1 in 100, that flow is referred to as the 100-year flow.

Flow path The route that stormwater runoff follows between two points of interest.

Forebay An easily maintained, extra storage area provided near an inlet of a BMP to trap incoming sediments before they accumulate in a pond or wetland BMP.

Forest management activities See SCC 30.91F.470.The growing and harvesting of trees, including all forest practices associated with continued management of forest lands for forest products and excluding those practices associated with the conversion of forest land to a non-forest use unless such lands are reforested to acceptable stocking levels as defined by WAC 222-34. Sludge utilization shall not be considered a forest management activity under this chapter. For purposes of this definition, the meaning of forest practices and forest lands shall be as defined in chapter 76.09 RCW.

Forest practice Any activity conducted on or directly pertaining to forest land and relating to growing, harvesting, or processing timber, including but not limited to:

a. Road and trail construction.

b. Harvesting, final and intermediate.

c. Precommercial thinning.

d. Reforestation.

e. Fertilization.

f. Prevention and suppression of diseases and insects.

g. Salvage of trees.

h. Brush control.

Forested Communities (wetlands) In general terms, communities (wetlands) characterized by woody vegetation that is greater than or equal to 6 meters in height; in this manual the term applies to such communities (wetlands) that represent a significant amount of tree cover consisting of species that offer wildlife habitat and other values and advance the performance of wetland functions overall.

Freeboard The vertical distance between the design water surface elevation and the elevation of the barrier that contains the water.

Frequently flooded Areas	The 100-year floodplain designations of the Federal Emergency Management Agency and the National Flood Insurance Program or as defined by the local government.
Frost-heave	The upward movement of soil surface due to the expansion of water stored between particles in the first few feet of the soil profile as it freezes. May cause surface fracturing of asphalt or concrete.
Frequency of storm (design storm frequency)	The anticipated period in years that will elapse, based on average probability of storms in the design region, before a storm of a given intensity and/or total volume will recur; thus a 10-year storm can be expected to occur on the average once every 10 years. Sewers designed to handle flows that occur under such storm conditions would be expected to be surcharged by any storms of greater amount or intensity.
Fully controlled limited access highway	A highway where the right of owner or occupants of abutting land or other persons to access, light, air, or view in connection with the highway is controlled to give preference to through traffic by providing access connections with selected public roads only, and by prohibiting crossings or direct private driveway connections at grade. (See WAC 468-58-010)
Functions	The ecological (physical, chemical, and biological) processes or attributes of a wetland without regard for their importance to society (see also values). Wetland functions include food chain support, provision of ecosystem diversity and fish and wildlife habitat, floodflow alteration, ground water recharge and discharge, water quality improvement, and soil stabilization.
Gabion	A rectangular or cylindrical wire mesh cage (a chicken wire basket) filled with rock and used as a protecting agent, revetment, etc., against erosion. Soft gabions, often used in streambank stabilization, are made of geotextiles filled with dirt, in between which cuttings are placed.
Gage or gauge	Device for registering precipitation, water level, discharge, velocity, pressure, temperature, etc. Also, a measure of the thickness of metal; e.g., diameter of wire, wall thickness of steel pipe.
Gaging station	A selected section of a stream channel equipped with a gage, recorder, or other facilities for determining stream discharge.

Geologist	See SCC 30.91G.030. A person who has received a degree in geology from an accredited college or university, or a person who has equivalent educational training and substantial experience as a practicing geologist.
Geologic hazard areas	See SCC 30.91G.020. Areas that because of their susceptibility to erosion, sliding, earthquake, or other geologic events, may not be suited to the siting of commercial, residential, or industrial development consistent with public health or safety concerns. Geologically hazardous areas include erosion hazard areas, landslide hazard areas, seismic hazard areas and mine hazard areas as defined in Chapter 30.91 SCC.
Geometrics	The mathematical relationships between points, lines, angles, and surfaces used to measure and identify areas of land.
Geotechnical professional civil engineer	A practicing, geotechnical/civil engineer licensed as a professional Civil Engineer with the State of Washington who has at least four years of professional employment as a geotechnical engineer in responsible charge, including experience with landslide evaluation.
Geotechnical engineer	See SCC 30.91G.040. A licensed civil engineer experienced and knowledgeable in the theory of soil mechanics, geology and geotechnical engineering.
Geotechnical engineering	See SCC 30.91G.050.The application of geologic knowledge and principles in the investigation and evaluation of naturally occurring rock and soil for use in the design of civil works projects. "Geotechnical engineering" also means the application of soils mechanics in the investigation, evaluation and design of civil works involving the use of earth materials and the inspection or testing thereof.
Grade	See SCC 30.91G.070.The elevation of the ground surface. (1) "Existing grade" means the elevation of the ground surface prior to development activity. (2) "Rough grade" means the stage at which the elevation of the ground surface approximately conforms to the approved plan. (3) "Finish grade" means the final elevation of the ground surface which conforms to the approved grading plan.

(To) Grade	To finish the surface of a canal bed, roadbed, top of embankment or bottom of excavation.
Gradient terrace	An earth embankment or a ridge-and-channel constructed with suitable spacing and an acceptable grade to reduce erosion damage by intercepting surface runoff and conducting it to a stable outlet at a stable nonerosive velocity.
Grassed waterway	A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses, used to conduct surface water from an area at a reduced flow rate. See also biofilter.
Groundwater	See SCC 30.91G.100. The portion of water contained in interconnected pores or fractures in a saturated zone or stratum located beneath the surface of the earth or below a surface water body.
Ground water Recharge	Inflow to a ground water reservoir.
Ground water table	The free surface of the ground water, that surface subject to atmospheric pressure under the ground, generally rising and falling with the season, the rate of withdrawal, the rate of restoration, and other conditions. It is seldom static.
Gully	A channel caused by the concentrated flow of surface and stormwater runoff over unprotected erodible land.
Habitat	The specific area or environment in which a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be protected from harmful biological, chemical, and physical alterations.
Hardpan	A cemented or compacted and often clay-like layer of soil that is impenetrable by roots. Also known as glacial till.
Harmful pollutant	A substance that has adverse effects to an organism including immediate death, chronic poisoning, impaired reproduction, cancer or other effects.
Head (hydraulics)	The height of water above any plane of reference. The energy, either kinetic or potential, possessed by each unit weight of a liquid, expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. Used in various compound terms such as pressure head, velocity head, and head loss.
Head loss	Energy loss due to friction, eddies, changes in velocity, or direction of flow.

Heavy metals Metals of high specific gravity, present in municipal and industrial wastes, that pose long-term environmental hazards. Such metals include cadmium, chromium, cobalt, copper, lead, mercury, nickel, and zinc.

High-use site High-use sites are those that typically generate high concentrations of oil due to high traffic turnover or the frequent transfer of oil. High-use sites include:

- An area of a commercial or industrial site subject to an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area;
- An area of a commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year, not including routinely delivered heating oil;
- An area of a commercial or industrial site subject to parking, storage or maintenance of 25 or more vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.);
- A road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.

Hog fuel See wood-based mulch.

Horton overland flow A runoff process whereby the rainfall rate exceeds the infiltration rate, so that the precipitation that does not infiltrate flows downhill over the soil surface.

Hydrological Simulation Program-Fortran (HSPF) A continuous simulation hydrologic model that transforms an uninterrupted rainfall record into a concurrent series of runoff or flow data by means of a set of mathematical algotrithms which represent the rainfall-runoff process at some conceptual level.

Humus Organic matter in or on a soil, composed of partly or fully decomposed bits of plant tissue or from animal manure.

Hydraulic Conductivity The quality of saturated soil that enables water or air to move through it. Also known as permeability coefficient

Hydraulic gradient Slope of the potential head relative to a fixed datum.

Hydrodynamics Means the dynamic energy, force, or motion of fluids as affected by the physical forces acting upon those fluids.

Hydrograph A graph of runoff rate, inflow rate or discharge rate, past a specific point over time.

Hydrologic cycle The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages or processes as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.

Hydrologic Soil Groups A soil characteristic classification system defined by the U.S. Soil Conservation Service in which a soil may be categorized into one of four soil groups (A, B, C, or D) based upon infiltration rate and other properties.

Type A: Low runoff potential. Soils having high infiltration rates, even when thoroughly wetted, and consisting chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Type B: Moderately low runoff potential. Soils having moderate infiltration rates when thoroughly wetted, and consisting chiefly of moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Type C: Moderately high runoff potential. Soils having slow infiltration rates when thoroughly wetted, and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textures. These soils have a slow rate of water transmission.

Type D: High runoff potential. Soils having very slow infiltration rates when thoroughly wetted, and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a hardpan, till, or clay layer at or near the surface, soils with a compacted subgrade at or near the surface, and shallow soils or nearly impervious material. These soils have a very slow rate of water transmission.[1]

[1] Vladimir Novotny and Harvey Olem. *Water Quality Prevention, Identification, and Management of Diffuse Pollution,* Van Nostrand Reinhold: New York, 1994, p. 109.

Hydrology The science of the behavior of water in the atmosphere, on the surface of the earth, and underground.

Hydroperiod A seasonal occurrence of flooding and/or soil saturation; it encompasses depth, frequency, duration, and seasonal pattern of inundation.

Hyetograph A graph of percentages of total precipitation for a series of time steps representing the total time in which precipitation occurs.

Illicit discharge All non-stormwater discharges to stormwater drainage systems that cause or contribute to a violation of state water quality, sediment quality or ground water quality standards, including but not limited to sanitary sewer connections, industrial process water, interior floor drains, car washing, and greywater systems.

Impact basin A device used to dissipate the energy of flowing water. Generally constructed of concrete in the form of a partially depressed or partially submerged vessel, it may utilize baffles to dissipate velocities.

Impervious A surface which cannot be easily penetrated. For instance, rain does not readily penetrate paved surfaces.

Impervious surface See SCC 30.91I.010. A hard surface area that either prevents or retards the entry of water into the soil mantle as compared to infiltration under natural conditions prior to development. A hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow that was present under natural conditions, prior to development. Common impervious surfaces include, but are not limited to, roofs, walkways, patios, driveways, parking lots, storage areas, concrete or asphalt paving, graveled areas and roads, packed earthen materials, surfaces covered by oil, macadam, asphalt treated base material (ATB), bituminous surface treatment (BST), chip seal, seal coat or emulsified asphalt and cutback asphalt cement, and other surfaces which similarly impede the natural infiltration of stormwater. Open, uncovered retention and detention facilities shall not be considered impervious surfaces for purposes of determining whether the thresholds for application of minimum stormwater management requirements are exceeded pursuant to chapter 30.63A SCC. However, open, uncovered retention and detention facilities shall be considered impervious surfaces for purposes of runoff modeling.

Impoundment A natural or man-made containment for surface water.

Improvement Streets (with or without curbs or gutters), sidewalks, crosswalks, parking lots, water mains, sanitary and storm sewers, drainage facilities, street trees and other appropriate items.

Industrial activities	Material handling, transportation, or storage; manufacturing; maintenance; treatment; or disposal. Areas with industrial activities include plant yards, access roads and rail lines used by carriers of raw materials, manufactured products, waste material, or by-products; material handling sites; refuse sites; sites used for the application or disposal of process waste waters; sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas for raw materials, and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to stormwater.
Infiltration	The hydrologic process of storm water runoff soaking into the subsoil, commonly referred to as percolation
Infiltration facility (or system)	A drainage facility designed to use the hydrologic process of surface and stormwater runoff soaking into the ground, commonly referred to as a percolation, to dispose of surface and stormwater runoff.
Infiltration rate	The rate, usually expressed in inches/hour, at which water moves downward (percolates) through the soil profile. Short-term infiltration rates may be inferred from soil analysis or texture or derived from field measurements. Long-term infiltration rates are affected by variability in soils and subsurface conditions at the site, the effectiveness of pretreatment or influent control, and the degree of long-term maintenance of the infiltration facility.
Ingress/egress	The points of access to and from a property.
Inlet	A form of connection between surface of the ground and a drain or sewer for the admission of surface and stormwater runoff.
Insecticide	A substance, usually chemical, that is used to kill insects.
Interception (Hydraulics)	The process by which precipitation is caught and held by foliage, twigs, and branches of trees, shrubs, and other vegetation. Often used for "interception loss" or the amount of water evaporated from the precipitation intercepted.

Interflow	That portion of rainfall that infiltrates into the soil and moves laterally through the upper soil horizons until intercepted by a stream channel or until it returns to the surface, for example, in a roadside ditch, wetland, spring or seep. Interflow is a function of the soil system depth, permeability, and water-holding capacity.
Intermittent stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources. It is dry for a large part of the year, ordinarily more than three months.
Invasive weedy plant species	Opportunistic species of inferior biological value that tend to out-compete more desirable forms and become dominant; applied to non-native species in this manual.
Invert	The lowest point on the inside of a sewer or other conduit.
Invert elevation	The vertical elevation of a pipe or orifice in a pond that defines the water level.
Isopluvial map	A map with lines representing constant depth of total precipitation for a given return frequency.
Lag time	The interval between the center of mass of the storm precipitation and the peak flow of the resultant runoff.

Lake

See SCC 30.91L.010. A body of freshwater that:

(1) Occurs in a depression of land or expanded part of a stream, including reservoirs;

(2) Is greater than 6.6 feet (2 meters) in depth at the deepest point at ordinary low water;

(3) Has less than 30% coverage by trees, shrubs, or persistent emergent vegetation; and.

(4) Has an ocean-derived salinity of less than 0.5 parts per thousand (ppt).

A lake is bounded by the ordinary high water mark, or, where a stream enters the lake, the extension of the elevation of the lake's ordinary high water mark within the stream. Lakes formed by a dam on a stream or river are bounded by a contour approximating the normal spillway elevation or normal pool elevation.

Lakes do not include artificial water bodies including, but not limited to, lakes constructed for irrigation or detention, wastewater treatment facilities, farm ponds, recreational or fishing ponds or other landscape ponds, unless they contain naturally occurring salmonids. Naturally occurring means that the salmonids have migrated into the lake via a connection to another water body containing salmonids and are not artificially introduced into the lake.

Land disturbing activity

See SCC 30.91L.025. Any activity that will result in movement of earth or a change in the existing soil cover or the existing soil topography (both vegetative and non-vegetative), including the creation and/or replacement of impervious surfaces. Land disturbing activities include, but are not limited to, clearing and grading. Land disturbing activities do not include agricultural plowing and tilling exempt from stormwater regulations pursuant to SCC 30.63A.200. Compaction that is associated with stabilization of structures and road construction also is a land disturbing activity. Vegetation and drainage facility maintenance practices are not land disturbing activities, provided that the maintenance is performed according to standards adopted by Snohomish County.

Landslide

See SCC 30.91L.030. Downslope movement of a mass of soil, rock, snow or ice including, but not limited to, rock falls, slumps, mud flows, debris flows, torrents, earth flows and snow avalanches.

Landslide hazard areas

See SCC 30.91L.040. Areas potentially subject to mass earth movement based on a combination of geologic, topographic, and hydrologic factors, with a vertical height of 10 feet or more. These include the following:

(1) Areas of historic landslides as evidenced by landslide deposits, avalanche tracks, and areas susceptible to basal undercutting by streams, rivers or waves;

(2) Areas with slopes steeper than 33 percent which intersect geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock, and which contain springs or ground water seeps; or

(3) Areas located in a canyon or an active alluvial fan, susceptible to inundation by debris flows or catastrophic flooding.

Leachable materials

Those substances that, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff. Examples include erodible soils, uncovered process wastes, manure, fertilizers, oil substances, ashes, kiln dust, and garbage dumpster leakage.

Leachate

Liquid that has percolated through soil and contains substances in solution or suspension.

Leaching

Removal of the more soluble materials from the soil by percolating waters.

Legume

A member of the legume or pulse family, Leguminosae, one of the most important and widely distributed plant families. The fruit is a "legume" or pod. Includes many valuable food and forage species, such as peas, beans, clovers, alfalfas, sweet clovers, and vetches. Practically all legumes are nitrogen-fixing plants.

Level pool routing

The basic technique of storage routing used for sizing and analyzing detention storage and determining water levels for ponding water bodies. The level pool routing technique is based on the continuity equation: Inflow – Outflow = Change in storage.

Level spreader

A temporary ESC device used to spread out stormwater runoff uniformly over the ground surface as sheet flow (i.e., not through channels). The purpose of level spreaders is to prevent concentrated, erosive flows from occurring, and to enhance infiltration.

Local government

Any county, city, town, or special purpose district having its own incorporated government for local affairs.

Low flow channel An incised or paved channel from inlet to outlet in a dry basin which is designed to carry low runoff flows and/or baseflow, directly to the outlet without detention.

Low permeable liner A layer of compacted till or clay, or a geomembrane.

Lowest floor See SCC 30.91L.220. The lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor only when such enclosure is built consistent with the applicable non-elevation design requirements of SCC 30.65.120(2)(b).

MDNS A Mitigated Determination of Nonsignificance (See DNS and Mitigation).

Maintenance See SCC 30.91M.011. Activities conducted on currently serviceable structures, facilities and equipment that involve no expansion or use beyond that previously existing and result in no significant adverse hydrologic impact. It includes those usual activities taken to prevent a decline, lapse or cessation in the use of structures and systems. Those usual activities may include replacement of dysfunctional facilities, including cases where any permit requires replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are not changed. This does not include expansion in physical dimension, capacity or use.

Manning's equation An equation used to predict the velocity of water flow in an open channel or pipelines:

$$V = \frac{1.486R^{2/3}S^{1/2}}{n}$$

where:

V is the mean velocity of flow in feet per second

R is the hydraulic radius in feet

S is the slope of the energy gradient or, for assumed uniform flow, the slope of the channel in feet per foot; and

n is Manning's roughness coefficient or retardance factor of the channel lining.

Mass wasting The movement of large volumes of earth material downslope.

Master drainage plan A comprehensive drainage control plan intended to prevent significant adverse impacts to the natural and manmade drainage system, both on and off-site.

Mean annual water level fluctuation Derived as follows:

(1) Measure the maximum water level (e.g., with a crest stage gage, Reinelt and Horner 1990) and the existing water level at the time of the site visit (e.g., with a staff gage) on at least eight occasions spread through a year.

(2) Take the difference of the maximum and existing water level on each occasion and divide by the number of occasions.

Mean depth Average depth; cross-sectional area of a stream or channel divided by its surface or top width.

Mean velocity The average velocity of a stream flowing in a channel or conduit at a given cross-section or in a given reach. It is equal to the discharge divided by the cross-sectional area of the reach.

Measuring weir A shaped notch through which water flows are measured. Common shapes are rectangular, trapezoidal, and triangular.

Mechanical analysis The analytical procedure by which soil particles are separated to determine the particle size distribution.

Mechanical practices Soil and water conservation practices that primarily change the surface of the land or that store, convey, regulate, or dispose of runoff water without excessive erosion.

Metals Elements, such as mercury, lead, nickel, zinc and cadmium, which are of environmental concern because they do not degrade over time. Although many are necessary nutrients, they are sometimes magnified in the food chain, and they can be toxic to life in high enough concentrations. They are also referred to as heavy metals.

Microbes The lower trophic levels of the soil food web. They are normally considered to include bacteria, fungi, flagellates, amoebae, ciliates, and nematodes. These in turn support the higher trophic levels, such as mites and earthworms. Together they are the basic life forms that are necessary for plant growth. Soil microbes also function to bioremediate pollutants such as petroleum, nutrients, and pathogens.

Mitigation See SCC 30.91M.120. "Mitigation" means:

(1) Avoiding the impact altogether by not taking a certain action or parts of an action;

(2) Minimizing impact by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;

(3) Rectifying the impact by repairing, rehabilitating or restoring the affected environment;

(4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;

(5) Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; or

(6) Monitoring the impact and taking appropriate corrective measures.

Modification, modified (wetland) A wetland whose physical, hydrological, or water quality characteristics have been purposefully altered for a management purpose, such as by dredging, filling, forebay construction, and inlet or outlet control.

Monitor To systematically and repeatedly measure something in order to track changes.

Monitoring The collection of data by various methods for the purposes of understanding natural systems and features, evaluating the impacts of development proposals on such systems, and assessing the performance of mitigation measures imposed as conditions of development.

NGPE See Native Growth Protection Easement.

NGVD National Geodetic Vertical Datum.

NPDES The National Pollutant Discharge Elimination System as established by the Federal Clean Water Act.

National Pollutant Discharge Elimination System (NPDES) The part of the federal Clean Water Act, which requires point source dischargers to obtain permits. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington State Department of Ecology.

Native Growth Protection Easement (NGPE) An easement granted for the protection of native vegetation within a critical area or its associated buffer. The NGPE shall be recorded on the appropriate documents of title and filed with the County Records Division.

Native vegetation Vegetation comprised of plant species, other than noxious weeds, that are indigenous to the coastal region of the Pacific Northwest and

	which reasonably could have been expected to naturally occur on the site. Examples include trees such as Douglas fir, Western Hemlock, Western Red Cedar, Alder, Big-leaf Maple, and Vine Maple; shrubs such as willow, elderberry, salmonberry and salal; and herbaceous plants such as sword fern, foam flower, and fireweed.
Natural location	Means the location of those channels, swales, and other non-manmade conveyance systems as defined by the first documented topographic contours existing for the subject property, either from maps or photographs, or such other means as appropriate. In the case of outwash soils with relatively flat terrain, no natural location of surface discharge may exist.
New development	See SCC 30.91N.044. The following land disturbing activities: Class IV - general forest practices that are conversions from timber land to other uses; structural development, including construction or installation of a building or other structure; creation of impervious surfaces; and subdivisions, short subdivisions, residential condomuniums, single-family detached units (SFDU), residential condominiums, planned residential developments (PRD) and binding site plans. Projects meeting the definition of redevelopment shall not be considered new development.
Nitrate (NO_3)	A form of nitrogen which is an essential nutrient to plants. It can cause algal blooms in water if all other nutrients are present in sufficient quantities. It is a product of bacterial oxidation of other forms of nitrogen, from the atmosphere during electrical storms and from fertilizer manufacturing.
Nitrification	The biochemical oxidation process by which ammonia is changed first to nitrites and then to nitrates by bacterial action, consuming oxygen in the water.
Nitrogen, Available	Usually ammonium, nitrite, and nitrate ions, and certain simple amines available for plant growth. A small fraction of organic or total nitrogen in the soil is available at any time.
Nonpoint source	
Pollution	Pollution that enters a waterbody from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances.
Normal depth	The depth of uniform flow. This is a unique depth of flow for any combination of channel characteristics and flow conditions. Normal depth is calculated using Manning's Equation.

NRCS Method	See SCS Method.
Nutrients	Essential chemicals needed by plants or animals for growth. Excessive amounts of nutrients can lead to degradation of water quality and algal blooms. Some nutrients can be toxic at high concentrations.
Off-line facilities	Water quality treatment facilities to which stormwater runoff is restricted to some maximum flow rate or volume by a flow-splitter.
Off-site	Any area lying upstream of the site that drains onto the site and any area lying downstream of the site to which the site drains.
Off-system storage	Facilities for holding or retaining excess flows over and above the carrying capacity of the stormwater conveyance system, in chambers, tanks, lagoons, ponds, or other basins that are not a part of the subsurface sewer system.
Oil/water separator	A vault, usually underground, designed to provide a quiescent environment to separate oil from water.
On-line facilities	Water quality treatment facilities which receive all of the stormwater runoff from a drainage area. Flows above the water quality design flow rate or volume are passed through at a lower percent removal efficiency.
On-site	The entire property that includes the proposed development.
On-site Stormwater Management BMPs	Site development techniques that serve to infiltrate, disperse, and retain stormwater runoff on-site.
Operational BMPs	Operational BMPs are a type of Source Control BMP. They are schedules of activities, prohibition of practices, and other managerial practices to prevent or reduce pollutants from entering stormwater. Operational BMPs include formation of a pollution prevention team, good housekeeping, preventive maintenance procedures, spill prevention and clean-up, employee training, inspections of pollutant sources and BMPs, and record keeping. They can also include process changes, raw material/product changes, and recycling wastes.

Ordinary high water mark

See SCC 30.91O.030. On all lakes, streams and tidal waters, is the mark that will be found by examining the beds and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, with respect to vegetation. The following criteria clarify this mark on tidal waters, lakes, and streams:

(1) Tidal waters.

(a) in high energy environments where the action of waves or currents is sufficient to prevent vegetation establishment below mean higher high tide, the ordinary high water mark is coincident with the line of vegetation. Where there is no vegetative cover for less than one hundred feet parallel to the shoreline, the ordinary high water mark is the average tidal elevation of the adjacent lines of vegetation. Where the ordinary high water mark cannot be found, it is the elevation of mean higher high tide.

(b) in low energy saltwater environments where the action of waves and currents is not sufficient to prevent vegetation establishment below mean higher high tide, the ordinary high water mark is coincident with the landward limit of hydrophytic salt tolerant vegetation. "Salt tolerant vegetation" means vegetation which is tolerant of interstitial soil salinities greater than or equal to 0.5 parts per thousand (ppt);

(c) In low energy freshwater environments where the action of the water is not sufficient to prevent vegetation establishment below the mean higher high tide, use the mean higher high tide elevation or one or more the following indicators: landward limits of drift logs or other drift deposits, presence of hydrophytic plants, presence of hydric soils, soil surface changes from algae, or sediment deposition areas to areas where the soils show no sign of depositional processes from water;

(2) Lakes. Where the ordinary high water mark cannot be found, it shall be the line of mean high water;

(3) Streams. Where the ordinary high water mark cannot be found, it shall be the line of mean high water. For braided streams, the ordinary high water mark is found on the banks forming the outer limits of the depression within which the braiding occurs.

Organic matter Organic matter as decomposed animal or vegetable matter. It is measured by ASTM D 2974. Organic matter is an important reservoir of carbon and a dynamic component of soil and the carbon cycle. It improves soil and plant efficiency by improving soil physical properties including drainage, aeration, and other structural characteristics. It contains the nutrients, microbes, and higher-form soil food web organisms necessary for plant growth. The maturity of organic matter is a measure of its beneficial properties. Raw organic matter can release water-soluble nutrients (similar to chemical fertilizer). Beneficial organic matter has undergone a humification process either naturally in the environment or through a composting process.

Orifice An opening with closed perimeter, usually sharp-edged, and of regular form in a plate, wall, or partition through which water may flow, generally used for the purpose of measurement or control of water.

Outlet Point of water disposal from a stream, river, lake, tidewater, or artificial drain.

Outlet channel A waterway constructed or altered primarily to carry water from man-made structures, such as terraces, tile lines, and diversions.

Outwash soils Soils formed from highly permeable sands and gravels.

Overflow A pipeline or conduit device, together with an outlet pipe, that provides for the discharge of portions of combined sewer flows into receiving waters or other points of disposal, after a regular device has allowed the portion of the flow which can be handled by interceptor sewer lines and pumping and treatment facilities to be carried by and to such water pollution control structures.

Overflow rate Detention basin release rate divided by the surface area of the basin. It can be thought of as an average flow rate through the basin.

Overtopping To flow over the limits of a containment or conveyance element.

Partially controlled limited access highway	A highway where the right of owner or occupants of abutting land or other persons to access, light, air, or view in connection with the highway is controlled to give preference to through traffic to a degree that, in addition to access connections with selected public roads, there may be some crossings and some private driveway connections at grade. (See WAC 468-58-010)
Particle Size	The effective diameter of a particle as measured by sedimentation, sieving, or micrometric methods.
Peak discharge	See SCC 30.91P.120. The maximum instantaneous rate of storm water runoff in cubic feet per second (cfs) or cubic meters per second (cms) determined for the design storm.
Peak-shaving	Controlling post-development peak discharge rates to pre-development levels by providing temporary detention in a BMP.
Percolation	The movement of water through soil.
Percolation rate	The rate, often expressed in minutes/inch, at which clear water, maintained at a relatively constant depth, will seep out of a standardized test hole that has been previously saturated. The term percolation rate is often used synonymously with infiltration rate (short-term infiltration rate).
Permanent Stormwater Control (PSC) Plan	A plan which includes permanent BMPs for the control of pollution from stormwater runoff after construction and/or land disturbing activity has been completed
Permeable soils	Soil materials with a sufficiently rapid infiltration rate so as to greatly reduce or eliminate surface and stormwater runoff. These soils are generally classified as SCS hydrologic soil types A and B.
Person	See SCC 30.91P.160. An individual, partnership, corporation, association, organization, cooperative, public or municipal corporation, or agency of the state or local governmental unit, or an agent or representative thereof.
Perviousness	Related to the size and continuity of void spaces in soils; related to a soil's infiltration rate.

Pesticide	A general term used to describe any substance - usually chemical - used to destroy or control organisms; includes herbicides, insecticides, algicides, fungicides, and others. Many of these substances are manufactured and are not naturally found in the environment. Others, such as pyrethrum, are natural toxins that are extracted from plants and animals.
pH	A measure of the alkalinity or acidity of a substance which is conducted by measuring the concentration of hydrogen ions in the substance. A pH of 7.0 indicates neutral water. A 6.5 reading is slightly acid.
Physiographic	Characteristics of the natural physical environment (including hills).
Plan Approval Authority	The Plan Approval Authority is defined as that department within a local government that has been delegated authority to approve stormwater site plans.
Planned unit development (PUD)	A special classification authorized in some zoning ordinances, where a unit of land under control of a single developer may be used for a variety of uses and densities, subject to review and approval by the local governing body. The locations of the zones are usually decided on a case-by-case basis.
Plat	A map or representation of a subdivision showing the division of a tract or parcel of land into lots, blocks, streets, or other divisions and dedications. (NOTE: See also SCC 30.91P.220 - "Plat, final," SCC 30.91P.230 - "Plat, final short," and SCC 30.91P.240 -"Plat, preliminary."
Plunge pool	A device used to dissipate the energy of flowing water that may be constructed or made by the action of flowing. These facilities may be protected by various lining materials.
Point discharge	The release of collected and/or concentrated surface and stormwater runoff from a pipe, culvert, or channel.
Point of compliance	The location at which compliance with a discharge performance standard or a receiving water quality standard is measured.

Pollution

Contamination or other alteration of the physical, chemical, or biological properties, of waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Pollution Generating Impervious surface

See SCC 30.91P.255. Those impervious surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces include those which are regularly subject to: vehicular use, industrial activities, or storage of erodible or leachable materials, wastes, or chemicals, and which receive direct rainfall or the run-on or blow-in of rainfall. Erodible or leachable materials, wastes, or chemicals are those substances which, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff and are PGIS. Examples include, but are not limited to, erodible soils that are stockpiled, uncovered process wastes, manure, fertilizers, oily substances, ashes, kiln dust, and garbage dumpster leakage. Metal roofs are also considered PGIS unless they are coated with an inert, non-leachable material such as baked-on enamel coating. The following surfaces are considered regularly-used by motor vehicles: roads, unvegetated road shoulders, bike lanes within the traveled lane of a roadway, driveways, parking lots, unfenced fire lanes, vehicular equipment storage yards, and airport runways. A surface, whether paved or not, shall be considered subject to vehicular use if it is regularly used by motor vehicles. The following surfaces are not considered to be regularly-used surfaces by motor vehicles: paved bicycle pathways separated from and not subject to drainage from roads for motor vehicles, fenced fire lanes, and infrequently used maintenance access roads.

Pollution-generating pervious surfaces

SCC 30.91P.256 SCC. Any non-impervious surface subject to use of pesticides and fertilizers or loss of soil. Typical PGPS include lawns, landscaped areas, golf courses, parks, cemeteries, and sports fields.

Predeveloped condition	See SCC 30.91P.258. A fully-forested condition (soils and vegetation) to which an Ecology-approved continuous runoff hydrologic model is calibrated, unless reasonable, historic information is provided that indicates the site was prairie prior to Euro-American settlement.
Prediction	For the purposes of this document an expected outcome based on the results of hydrologic modeling and/or the judgment of a trained professional civil engineer or geologist.
Pretreatment	The removal of material such as solids, grit, grease, and scum from flows prior to physical, biological, or physical treatment processes to improve treatability. Pretreatment may include screening, grit removal, settling, oil/water separation, or application of a Basic Treatment BMP prior to infiltration.
Priority peat systems	Unique, irreplaceable fens that can exhibit water pH in a wide range from highly acidic to alkaline, including fens typified by Sphagnum species, Ledum groenlandicum (Labrador tea), Drosera rotundifolia (sundew), and Vaccinium oxycoccos (bog cranberry); marl fens; estuarine peat deposits; and other moss peat systems with relatively diverse, undisturbed flora and fauna. Bog is the common name for peat systems having the Sphagnum association described, but this term applies strictly only to systems that receive water income from precipitation exclusively.
Professional civil Engineer	A person registered with the state of Washington as a professional engineer in civil engineering.
Project	Any proposed action to alter or develop a site. The proposed action of a permit application or an approval, which requires drainage review.
Project site	See SCC 30.91P.354. That portion of a property, properties, or right of way subject to land disturbing activities, new impervious surfaces, or replaced impervious surfaces.
Project proponent	See SCC 30.91P.352. Any individual, person, partnership, corporation, association, organization, cooperative, public or municipal corporation, or agency of the state or local governmental unit, or an agent or representative thereof proposing a development activity or project permit.

Properly Functioning Soil System (PFSS)	Equivalent to engineered soil/landscape system. This can also be a natural system that has not been disturbed or modified.
Public regional Stormwater management facility	See SCC 30.91P.400. A retention or detention facility serving more than one site and constructed or owned by a public agency.
Puget Sound basin	Puget Sound south of Admiralty Inlet (including Hood Canal and Saratoga Passage); the waters north to the Canadian border, including portions of the Strait of Georgia; the Strait of Juan de Fuca south of the Canadian border; and all the lands draining into these waters as mapped in Water Resources Inventory Areas numbers 1 through 19, set forth in WAC 173-500-040.
R/D	See Retention/detention facility.
Rare, threatened, or endangered species	Plant or animal species that are regional relatively uncommon, are nearing endangered status, or whose existence is in immediate jeopardy and is usually restricted to highly specific habitats. Threatened and endangered species are officially listed by federal and state authorities, whereas rare species are unofficial species of concern that fit the above definitions.
Rational method	A means of computing storm drainage flow rates (Q) by use of the formula Q = CIA, where C is a coefficient describing the physical drainage area, I is the rainfall intensity and A is the area. This method is no longer used in the technical manual.
Reach	A length of channel with uniform characteristics.
Receiving waters	See SCC 30.91R.027.1. Bodies of water or surface water systems to which surface runoff is discharged via a point source of stormwater or via sheet flow.
Recharge	The addition of water to the zone of saturation (i.e., an aquifer).

Recommended BMPs	As used in Volume IV, recommended BMPs are those BMPs that are not expected to be mandatory by local governments at new development and redevelopment sites. However, they may improve pollutant control efficiency, and may provide a more comprehensive and environmentally effective stormwater management program.
Redevelopment	See SCC 30.91R.070. The following activities that take place on a site that already has 35 percent or more existing impervious surface coverage: the creation of new impervious surface(s); structural development including construction, installation, expansion or replacement of a building footprint or other structure; replacement of existing impervious surface that is not maintenance; and land disturbing activity.
Regional	An action (here, for stormwater management purposes) that involves more than one discrete property.
Regional detention Facility	See 30.91P.400 "Public regional storm water management facility (public regional facility)".
Release rate	The computed peak rate of surface and stormwater runoff from a site.
Replaced impervious surface	See SCC 30.91R.121. For structures, the removal of impervious surfaces and replacement of any exterior impervious surfaces or foundation for other impervious surfaces, or the removal down to bare soil or base course and the replacement with other impervious surfaces.
Residential density	The number of dwelling units per unit of surface area. Net density includes only occupied land. Gross density includes unoccupied portions of residential areas, such as roads and open space.
Restoration	Actions performed to reestablish wetland functional characteristics and processes that have been lost by alterations, activities, or catastrophic events in an area that no longer meets the definition of a wetland.
Retention	The process of collecting and holding surface and stormwater runoff with no surface outflow.
Retention facility	See SCC 30.91R.170. An open or closed facility, such as a pond or tank, that stores storm water runoff without release except by means of evaporation, plant transpiration or infiltration into the ground. The facility includes the flow control structure, the infiltration system, the inlet and outlet pipes, and all maintenance access points.

Retrofitting	The renovation of an existing structure or facility to meet changed conditions or to improve performance.
Return frequency	A statistical term for the average time of expected interval that an event of some kind will equal or exceed given conditions (e.g., a stormwater flow that occurs every 2 years).
Rhizome	A modified plant stem that grows horizontally underground.
Riffles	Fast sections of a stream where shallow water races over stones and gravel. Riffles usually support a wider variety of bottom organisms than other stream sections.
Rill	A small intermittent watercourse with steep sides, usually only a few inches deep. Often rills are caused by an increase in surface water flow when soil is cleared of vegetation.
Riprap	A facing layer or protective mound of rocks placed to prevent erosion or sloughing of a structure or embankment due to flow of surface and stormwater runoff.
Riparian	Pertaining to the banks of streams, wetlands, lakes, or tidewater.
Riser	A vertical pipe extending from the bottom of a pond BMP that is used to control the discharge rate from a BMP for a specified design storm.
Road, private	See SCC 30.91R.230. A privately maintained easement or parcel created to provide vehicle access from a public road to one or more lots, and where appropriate, may include pedestrian, equestrian and bicycle facilities. Limits may include the outside edge of sidewalks, or curbs and gutters, planter strips, paths, walkways, or side ditches, including the appertaining shoulder and all slopes, ditches, channels, waterways, and other features necessary for proper drainage and structural stability within the easement or parcel.
Rodenticide	A substance used to destroy rodents.
Runoff	See SCC 30.91R.252. Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow groundwater. It includes the portion of rainfall or other precipitation that becomes surface flow and interflow.
SCS	Soil Conservation Service (now the Natural Resources Conservation Service), U.S. Department of Agriculture
SCS Method	A single-event hydrologic analysis technique for estimating runoff based on the Curve Number method. The Curve Numbers are

	published by NRCS *in Urban Hydrology for Small Watersheds, 55 TR, June 1976*. With the change in name to the Natural Resource Conservation Service, the method may be referred to as the NRCS Method.
SEPA	See State Environmental Policy Act.
Salmonid	See SCC 30.91S.010 A member of the fish family salmonidae including chinook, coho, chum, sockeye, and pink salmon; rainbow, steelhead, searun cutthroat, cutthroat trout, brown and bull trout; brook and Dolly Varden char; kokanee and whitefish.
Sand filter	A man-made depression or basin with a layer of sand that treats stormwater as it percolates through the sand and is discharged via a central collector pipe.
Saturation point	In soils, the point at which a soil or an aquifer will no longer absorb any amount of water without losing an equal amount.
Scour	Erosion of channel banks due to excessive velocity of the flow of surface and stormwater runoff.
Sediment	Fragmented material that originates from weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.
Sedimentation	The depositing or formation of sediment.
Sensitive emergent Vegetation Communities	Assemblages of erect, rooted, herbaceous vegetation, excluding mosses and lichens, at least some of whose members have relatively narrow ranges of environmental requirements, such as hydroperiod, nutrition, temperature, and light. Examples include fen species such as sundew and, as well as a number of species of Carex (sedges).
Sensitive life stages	Stages during which organisms have limited mobility or alternatives in securing the necessities of life, especially including reproduction, rearing, and migration periods.

Sensitive scrub-shrub Vegetation Communities — Assemblages of woody vegetation less than 6 meters in height, at least some of whose members have relatively narrow ranges of environmental requirements, such as hydroperiod, nutrition, temperature, and light. Examples include fen species such as Labrador tea, bog laurel, and cranberry.

Settleable solids — Those suspended solids in stormwater that separate by settling when the stormwater is held in a quiescent condition for a specified time.

Sheet erosion — The relatively uniform removal of soil from an area without the development of conspicuous water channels.

Sheet flow — Runoff that flows over the ground surface as a thin, even layer, not concentrated in a channel.

Shoreline development — The proposed project as regulated by the Shoreline Management Act. Usually the construction over water or within a shoreline zone (generally 200 feet landward of the water) of structures such as buildings, piers, bulkheads, and breakwaters, including environmental alterations such as dredging and filling, or any project which interferes with public navigational rights on the surface waters.

Short circuiting — The passage of runoff through a BMP in less than the design treatment time.

Siltation — The process by which a river, lake, or other waterbody becomes clogged with sediment. Silt can clog gravel beds and prevent successful salmon spawning.

Site — See SCC 30.91S.350. The area defined by the legal boundaries of a parcel or parcels of land that is (are) subject to new development or redevelopment including contiguous improvements in the right of way. For road projects, the length of the project site and right-of-way boundaries define the site.

Slope — See SCC 30.91S.380. An inclined ground surface, the inclination of which is expressed as a ratio of horizontal distance to vertical distance or as a percentage of rise over run (vertical over horizontal distance. (See figure 30.91S.400 for illustrations) Average slope is determined for the site by using the time of concentration line as the horizontal length and the vertical difference along said line. Slope is the vertical difference divided by the horizontal length expressed as a percentage. The overall site risk is based on the highest risk slope being disturbed with an area of 5,000 square feet or more.

Sloughing The sliding of overlying material. It is the same effect as caving, but it usually occurs when the bank or an underlying stratum is saturated or scoured.

Soil See SCC 30.91S.460. The naturally occurring, unconsolidated mineral and organic material deposits overlying bedrock.

Soil group, hydrologic A classification of soils by the Soil Conservation Service into four runoff potential groups. The groups range from A soils, which are very permeable and produce little or no runoff, to D soils, which are not very permeable and produce much more runoff.

Soil horizon A layer of soil, approximately parallel to the surface, which has distinct characteristics produced by soil-forming factors.

Soil profile A vertical section of the soil from the surface through all horizons, including C horizons.

Soil structure The relation of particles or groups of particles which impart to the whole soil a characteristic manner of breaking; some types are crumb structure, block structure, platy structure, and columnar structure.

Soil permeability The ease with which gases, liquids, or plant roots penetrate or pass through a layer of soil.

Soil stabilization The use of measures such as rock lining, vegetation or other engineering structures to prevent the movement of soil when loads are applied to the soil.

Soil Texture Class The relative proportion, by weight, of particle sizes, based on the USDA system, of individual soil grains less than 2 mm equivalent diameter in a mass of soil. The basic texture classes in the approximate order of increasing proportions of fine particles include: sand, loamy sand, sandy loam, loam, silt loam, silt, clay loam, sandy clay, silty clay, and clay.

Sorption The physical or chemical binding of pollutants to sediment or organic particles.

Source control best management practice See SCC 30.91S.521. Structures, equipment, supplies or operations intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants.

Spill control device A Tee section or turn down elbow designed to retain a limited volume of pollutant that floats on water, such as oil or antifreeze. Spill control devices are passive and must be cleaned-out for the spilled pollutant to actually be removed.

Spillway A passage such as a paved apron or channel for surplus water over or around a dam or similar obstruction. An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, either manually or automatically controlled, to regulate the discharge of excess water.

State Environmental Policy Act (SEPA) RCW 43.21C The Washington State law intended to minimize environmental damage. SEPA requires that state agencies and local governments consider environmental factors when making decisions on activities, such as development proposals over a certain size and comprehensive plans. As part of this process, environmental documents are prepared and opportunities for public comment are provided.

Steep slope Slopes of 40 percent gradient or steeper within a vertical elevation change of at least ten feet. A slope is delineated by establishing its toe and top, and is measured by averaging the inclination over at least ten feet of vertical relief. For the purpose of this definition:

The toe of a slope is a distinct topographic break in slope that separates slopes inclined at less than 40% from slopes 40% or steeper. Where no distinct break exists, the toe of a steep slope is the lower-most limit of the area where the ground surface drops ten feet or more vertically within a horizontal distance of 25 feet; AND

The top of a slope is a distinct topographic break in slope that separates slopes inclined at less than 40% from slopes 40% or steeper. Where no distinct break exists, the top of a steep slope is the upper-most limit of the area where the ground surface drops ten feet or more vertically within a horizontal distance of 25 feet.

Storage routing A method to account for the attenuation of peak flows passing through a detention facility or other storage feature.

Storm drains The enclosed conduits that transport surface and stormwater runoff toward points of discharge (sometimes called storm sewers).

Storm frequency The time interval between major storms of predetermined intensity and volumes of runoff for which storm sewers and other structures are designed and constructed to handle hydraulically without surcharging and backflooding, e.g., a 2-year, 10-year or 100-year storm.

Storm sewer A sewer that carries stormwater and surface water, street wash and other wash waters or drainage, but excludes sewage and industrial wastes. Also called a storm drain.

Stormwater That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes and other features of a stormwater drainage system into a defined surface waterbody, or a constructed infiltration facility.

Stormwater drainage System Constructed and natural features which function together as a system to collect, convey, channel, hold, inhibit, retain, detain, infiltrate, divert, treat or filter stormwater.

Stormwater facility A system of collecting, conveying, and storing stormwater runoff. Stormwater facilities include, but are not limited to, all stormwater conveyance systems and containment facilities including pipelines, channels, dikes, ditches, closed depressions, infiltration facilities, retention facilities, detention facilities, stormwater treatment facilities, erosion and sedimentation control facilities, and other drainage structures and appurtenances, both natural and artificial.

Stormwater Site Plan The comprehensive report containing all of the technical information and analysis necessary for regulatory agencies to evaluate a proposed new development or redevelopment project for compliance with stormwater requirements. Contents of the Stormwater Site Plan will vary with the type and size of the project, and individual site characteristics. It includes a Stormwater Pollution Prevention Plan (SWPPP) and a Permanent Stormwater Control Plan (PSC Plan). Guidance on preparing a Stormwater Site Plan is contained in Chapter 3 of Volume I.

Strahler stream order See SCC 30.91S.637. The hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Two first-order streams flow together to form a second-order stream, two second-order streams combine to make a third-order stream, etc. (Strahler 1957). This ordering method starts at zero at each terminal segment, and proceeds towards the root stream. Each time a bifurcation node is encountered, if both daughter branches have the same order, then the order is increased by one, otherwise the largest order is used.

Stream gaging The quantitative determination of stream flow using gages, current meters, weirs, or other measuring instruments at selected locations. See Gaging station.

Streambanks The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.

Stream See SCC 30.91S.640. Those areas where naturally occurring surface waters flow sufficiently to produce a defined channel or bed which demonstrates evidence of the passage of water including, but not limited to, bedrock channels, gravel beds, sand and silt beds and defined-channel swales. A defined channel or bed means a water course that is scoured by water or contains deposits of mineral alluvium. The channel or bed need not contain water during the entire year. Streams do not include water courses which were created entirely by artificial means, such as irrigation ditches, canals, roadside ditches or storm or surface water run-off features, unless the artificially created water course contains salmonids or conveys a stream that was naturally occurring prior to the construction of the artificially created water course.

Structure A catchbasin or manhole in reference to a storm drainage system.

Structural source control BMPs Physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. Structural source control BMPs typically include:

- Enclosing and/or covering the pollutant source (building or other enclosure, a roof over storage and working areas, temporary tarp, etc.).
- Segregating the pollutant source to prevent run-on of stormwater, and to direct only contaminated stormwater to appropriate treatment BMPs.

Stub-out A short length of pipe provided for future connection to a storm drainage system.

Subbasin A drainage area that drains to a water-course or waterbody named and noted on common maps and which is contained within a basin.

Subcatchment A subdivision of a drainage basin (generally determined by topography and pipe network configuration).

Subdrain A pervious backfilled trench containing stone or a pipe for intercepting ground water or seepage.

Subgrade A layer of stone or soil used as the underlying base for a BMP.

Subsoil The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below the

	plowed soil (or its equivalent of surface soil), in which roots normally grow. Although a common term, it cannot be defined accurately. It has been carried over from early days when "soil" was conceived only as the plowed soil and that under it as the "subsoil."
Substrate	The natural soil base underlying a BMP.
Surcharge	The flow condition occurring in closed conduits when the hydraulic grade line is above the crown of the sewer.
Surface water	See SCC 30.91S.760. Waters that flow over the land surface and frequently interact with groundwater.
Surface and Stormwater	Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes, and wetlands as well as shallow ground water.
Surface and stormwater Management System	Drainage facilities and any other natural features that collect, store, control, treat and/or convey surface and stormwater.
Suspended solids	Organic or inorganic particles that are suspended in and carried by the water. The term includes sand, mud, and clay particles (and associated pollutants) as well as solids in stormwater.
Swale	A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot.
Terrace	An embankment or combination of an embankment and channel across a slope to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope.
Threshold Discharge Area	See SCC 30.91T.054B. An onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream (as determined by the shortest flowpath).
Tightline	A continuous length of pipe that conveys water from one point to another (typically down a steep slope) with no inlets or collection points in between.
Tile, Drain	Pipe made of burned clay, concrete, or similar material, in short lengths, usually laid with open joints to collect and carry excess water from the soil.

Tile drainage	Land drainage by means of a series of tile lines laid at a specified depth and grade.
Till	A layer of poorly sorted soil deposited by glacial action that generally has very low infiltration rates.
Time of concentration	The time period necessary for surface runoff to reach the outlet of a subbasin from the hydraulically most remote point in the tributary drainage area.
Timber	See SCC 30.91T.254. Forest trees, standing or down, of a commercial species, including Christmas trees. Timber does not include Christmas trees that are cultivated by agricultural methods, as that term is defined in RCW 84.33.035.
Topography	General term to include characteristics of the ground surface such as plains, hills, mountains, degree of relief, steepness of slopes, and other physiographic features.
Topsoil	Topsoil shall be per ASTM D5268 standard specification, and water permeability shall be 0.6 inches per hour or greater. Organic matter shall have not more than 10 percent of nutrients in mineralized water-soluble forms. Topsoil shall not have phytotoxic characteristics.
Total dissolved solids	The dissolved salt loading in surface and subsurface waters.
Total Petroleum Hydrocarbons (TPH)	TPH-Gx: The qualitative and quantitative method (extended) for volatile ("gasoline") petroleum products in water; and TPH-Dx: The qualitative and quantitative method (extended) for semi-volatile ("diesel") petroleum products in water.
Total solids	The solids in water, sewage, or other liquids, including the dissolved, filterable, and nonfilterable solids. The residue left when the moisture is evaporated and the remainder is dried at a specified temperature, usually 130°C.
Total suspended Solids	That portion of the solids carried by stormwater that can be captured on a standard glass filter.
Toxic	Poisonous, carcinogenic, or otherwise directly harmful to life.
Tract	A legally created parcel of property designated for special nonresidential and noncommercial uses.

Trash rack	A structural device used to prevent debris from entering a spillway or other hydraulic structure.
Travel time	The estimated time for surface water to flow between two points of interest.
Treatment BMP	A BMP that is intended to remove pollutants from stormwater. A few examples of treatment BMPs are Wetponds, oil/water separators, biofiltration swales, and constructed wetlands.
Treatment liner	A layer of soil that is designed to slow the rate of infiltration and provide sufficient pollutant removal so as to protect groundwater quality.
Treatment train	A combination of two or more treatment facilities connected in series.
Turbidity	Dispersion or scattering of light in a liquid, caused by suspended solids and other factors; commonly used as a measure of suspended solids in a liquid.
Underdrain	Plastic pipes with holes drilled through the top, installed on the bottom of an infiltration BMP, which are used to collect and remove excess runoff.
Undisturbed buffer	A zone where development activity shall not occur, including logging, and/or the construction of utility trenches, roads, and/or surface and stormwater facilities.
Undisturbed low gradient uplands	Forested land, sufficiently large and flat to infiltrate surface and storm runoff without allowing the concentration of water on the surface of the ground.
Unstable slopes	Those sloping areas of land which have in the past exhibited, are currently exhibiting, or will likely in the future exhibit, mass movement of earth.
Unusual biological community types	Assemblages of interacting organisms that are relatively uncommon regionally.
Urbanized area	Areas designated and identified by the U.S. Bureau of Census according to the following criteria: an incorporated place and densely settled surrounding area that together have a maximum population of 50,000.
U.S. EPA	The United States Environmental Protection Agency.

Values	Wetland processes or attributes that are valuable or beneficial to society (also see Functions). Wetland values include support of commercial and sport fish and wildlife species, protection of life and property from flooding, recreation, education, and aesthetic enhancement of human communities.
Variance	See Exception.
Vegetation	All organic plant life growing on the surface of the earth.
Vegetation or effective cover	Ground that has natural permanent growth sufficient to resist erosion during normal winter rainstorm events.
Waterbody	Surface waters including rivers, streams, lakes, marine waters, estuaries, and wetlands.
Water quality	See SCC 30.91W.025. The chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose.
Water quality design Storm	The 24-hour rainfall amount with a 6-month return frequency. Commonly referred to as the 6-month, 24-hour storm.
Water quality standards	Minimum requirements of purity of water for various uses; for example, water for agricultural use in irrigation systems should not exceed specific levels of sodium bicarbonate, pH, total dissolved salts, etc. In Washington, the Department of Ecology sets water quality standards.
Watershed	A geographic region within which water drains into a particular river, stream, or body of water. Watersheds can be as large as those identified and numbered by the State of Washington Water Resource Inventory Areas (WRIAs) as defined in Chapter 173-500 WAC.
Water table	The upper surface or top of the saturated portion of the soil or bedrock layer, indicates the uppermost extent of ground water.
Weir	Device for measuring or regulating the flow of water.
Weir notch	The opening in a weir for the passage of water.

Wetlands

See SCC 30.91W.060. "Wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include, but are not limited to swamps, marshes, bogs, and similar areas, as well as artificial wetlands intentionally created from non-wetland areas to mitigate for conversion of wetlands, as permitted by the county. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to irrigation and drainage ditches, grass-lined biofiltration swales, canals, detention facilities, wastewater treatment facilities, farm ponds and landscaping amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. The detailed methodology for wetland delineation is contained in Washington State Wetlands Identification and Delineation Manual Washington State Department of Ecology, Publication #96-94, March 1997 Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands.

Wetland edge

Delineation of the wetland edge shall be based on the U.S. Army Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1, U.S. Army Engineers Waterways Experiment Station, Vicksburg, Miss. (1987)

Wetponds and Wetvaults

Drainage facilities for water quality treatment that contain permanent pools of water that are filled during the initial runoff from a storm event. They are designed to optimize water quality by providing retention time in order to settle out particles of fine sediment to which pollutants such as heavy metals absorb, and to allow biologic activity to occur that metabolizes nutrients and organic pollutants.

Wetpool

A pond or constructed wetland that stores runoff temporarily and whose normal discharge location is elevated so as to maintain a permanent pool of water between storm events.

Zoning

See SCC 30.91Z.030. The process by which the county legally controls the use of property and physical configuration of development upon tracts of land within its jurisdiction by establishing zones and adopting the zoning map. Zoning is an official control that implements the comprehensive plan and is enacted for the protection of the public health, safety and welfare.